City of Whittier
2016 Natural Hazards Mitigation Plan

Final Plan

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Prepared under contract with:
Emergency Planning Consultants
San Diego, California

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Credits

Acknowledgements

City of Whittier City Council

- Fernando Dutra, Mayor
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City of Whittier Administration

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Special Thanks

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Note: The maps in this plan were provided by the City of Whittier, County of Los Angeles, Federal Emergency Management Agency (FEMA), or were acquired from public internet sources. Care was taken in the creation of the maps contained in this Plan, however they are provided "as is". The City of Whittier cannot accept any responsibility for any errors, omissions or positional accuracy, and therefore, there are no warranties that accompany these products (the maps). Although information from land surveys may have been used in the creation of these products, in no way does this product represent or constitute a land survey. Users are cautioned to field verify information on this product before making any decisions.

Mandated Contents

In an effort to assist the reader and reviewer of this document the jurisdiction has inserted the mandated contents as identified in the Disaster Mitigation Act of 2000 (Public Law – 390). Following is an example of those references – inserted as footnotes throughout the plan.

EXAMPLE

ELEMENT A: PLANNING PROCESS | A1
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement§201.6(c)(1))

Table of Contents

Part I: BACKGROUND

Executive Summary

The Natural Hazards Mitigation Plan (Mitigation Plan) was prepared in response to Disaster Mitigation Act of 2000 (DMA 2000). DMA 2000 (also known as Public Law 106-390) requires state and local governments to prepare Mitigation Plans to document their Mitigation Planning process, and identify hazards, potential losses, mitigation needs, goals, and strategies. This type of planning supplements the City's comprehensive emergency management program.

Under DMA 2000, each state and local government must have a federally approved Mitigation Plan to be eligible for hazard mitigation grant funding. This is the third mitigation plan prepared for the City of Whittier. Preceding plans were approved by FEMA in 2005 and 2010.

The Disaster Mitigation Act of 2000 (DMA 2000) is intended to facilitate cooperation between state and local governments, prompting them to work together. Through collaboration, mitigation needs can be identified before disasters strike, resulting in faster allocation of resources and more effective risk reduction projects.

The following FEMA definitions are used throughout this plan:

Hazard Mitigation – "Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards".

Planning – "The act or process of making or carrying out plans; specifically, the establishment of goals, policies, and procedures for a social or economic unit."
(Source: FEMA, 2002, *Getting Started, Building Support for Mitigation Planning*, FEMA 386-1)

Mitigation Planning Benefits

Planning ahead helps residents, businesses, and government agencies effectively respond when disasters strike; and keeps public agencies eligible for Hazard Mitigation Grant Program (HMGP) funding. The long-term benefits of mitigation planning include:

- ✓ Greater understanding of hazards faced by a community
- ✓ Use of limited resources on hazards with the greatest effect on a community
- ✓ Financial savings through partnerships for planning and mitigation
- ✓ Reduced long-term impacts and damages to human health and structures, and lower repair costs
- ✓ More sustainable, disaster-resistant communities.

Hazard Land Use Policy in California

Planning for hazards should be an integral element of any city's land use planning program. All California cities and counties have General Plans and the implementing ordinances that are required to comply with the statewide land use planning regulations.

The continuing challenge faced by local officials and state government is to keep the network of local plans effective in responding to the changing conditions and needs of California's diverse communities, particularly in light of the very active seismic region in which we live.

Planning for hazards requires a thorough understanding of the various hazards facing the City and region as a whole. Additionally, it's important to take an inventory of the structures and contents of various City holdings. These inventories should include the compendium of hazards facing the city, the built environment at risk, the personal property that may be damaged by hazard events and most of all, the people who live in the shadow of these hazards.

Support for Hazard Mitigation

All mitigation is local and the primary responsibility for development and implementation of risk reduction strategies and policies lies with each local jurisdiction. Local jurisdictions, however, are not alone. Partners and resources exist at the regional, state and federal levels. Numerous California state agencies have a role in hazards and hazard mitigation.

Some of the key agencies include:

- ✓ California Office of Emergency Services (Cal OES) is responsible for disaster mitigation, preparedness, response, recovery, and the administration of federal funds after a major disaster declaration;
- ✓ Southern California Earthquake Center (SCEC) gathers information about earthquakes, integrates information on earthquake phenomena, and communicates this to end-users and the general public to increase earthquake awareness, reduce economic losses, and save lives.
- ✓ California Department of Forestry and Fire Protection (CAL FIRE) is responsible for all aspects of wildland fire protection on private and state properties, and administers forest practices regulations, including landslide mitigation, on non-federal lands.
- ✓ California Division of Mines and Geology (DMG) is responsible for geologic hazard characterization, public education, and the development of partnerships aimed at reducing risk.
- ✓ California Division of Water Resources (DWR) plans, designs, constructs, operates, and maintains the State Water Project; regulates dams; provides flood protection and assists in emergency management. It also educates the public, serves local water needs by providing technical assistance
- ✓ FEMA provides hazard mitigation guidance, resource materials, and educational materials to support implementation of the capitalized DMA 2000.
- ✓ United States Census Bureau (USCB) provides demographic data on the populations affected by natural disasters.
- ✓ United States Department of Agriculture (USDA) provides data on matters pertaining to land management.

A Hazard Mitigation Planning Team (Planning Team) consisting of City and County staff from various departments worked with Emergency Planning Consultants using the following approach to create the 2016 Mitigation Plan:

- ✓ Identify hazards posing a significant threat
- ✓ Profile these hazards
- ✓ Estimate inventory at risk and potential losses associated with these hazards

- ✓ Develop mitigation strategies and goals that address these hazards
- ✓ Develop plan maintenance procedures for implementation after the joint review by Cal OES and FEMA and FEMA approval.

The requirements of DMA 2000 only apply to natural hazards. The Planning Team chose to continue to focus on natural hazards for the 2016 update.

As required by DMA 2000, the City informed the public about the planning process and provided opportunities for public input. In addition, key agencies and stakeholders shared their expertise during the planning process. This Mitigation Plan documents the process, outcome, and future of the City's mitigation planning efforts.

How is the Plan Organized?

The structure of the plan enables people to use a section of interest to them and allows the City to review and update sections when new data is available. The ease of incorporating new data into the plan will result in a Mitigation Plan that remains current and relevant to the City of Whittier.

Following is a description of each part and section of the plan:

Part I: Background

Executive Summary

The Executive Summary provides a very general overview of mitigation planning, the planning process, and the steps involved in implementing the plan.

Section 1: Introduction

The Introduction describes the background and purpose of developing the Mitigation Plan for the City of Whittier.

Section 2: Community Profile

The section presents the history, geography, demographics, and socioeconomics of the City of Whittier. It provides valuable information on the demographics and history of the region.

Part II: Hazard Analysis

This section provides information on the process used to assess the demographics and development patterns for the community along with an assessment of the hazards.

Section 3: Risk Assessment

This section provides information on hazard identification, vulnerability and risk associated with hazards in the City of Whittier.

Sections 4-7: Hazard-Specific Analysis

Hazard-Specific Analysis includes discussion on the four chronic hazards identified by the Planning Team. Chronic hazards are defined as those occurring with some regularity and may be predicted through historic evidence and scientific methods. The chronic hazards addressed in the plan include:

Section 4: Earthquake
Section 5: Flood

Section 6: Wildfire
Section 7: Drought

Each Hazard-Specific Analysis includes information on the history, hazard causes, hazard characteristics, and hazard assessment.

Part III: Mitigation Strategies

Section 8: Mitigation Strategies

This section highlights the Mitigation Actions Matrix and: 1) past accomplishments; 2) planning approach; 3) goals and objectives; 4) identification, analysis, and implementation of mitigation activities; 5) prioritized mitigation activities; and 6) next steps.

Section 9: Planning Process

This section describes the mitigation planning process including 1) Planning Team involvement, 2) extended Planning Team support, 3) public and other stakeholder involvement; and 4) integration of existing data and plans.

Section 10: Plan Maintenance

This section provides information on plan implementation, monitoring and evaluation.

Part IV: Appendices

The plan appendices are designed to provide users of the Mitigation Plan with additional information to assist them in understanding the contents of the mitigation plan, and potential resources to assist them with implementation.

Appendix A: Benefit/Cost Analysis

This section describes FEMA's requirements for benefit cost analysis in hazards mitigation, as well as various approaches for conducting economic analysis of proposed mitigation activities.

Mitigation Planning Process

The process for creating the 2016 update to the Natural Hazards Mitigation Plan started with identifying members for the Planning Team. Each team member represented different City department and specific divisions within those departments with a role in mitigation efforts. The Planning Team met and identified characteristics and consequences of natural hazards with significant potential to affect the City.

Hazard mitigation strategy and goals were developed by understanding the risk posed by the identified hazards. The group also determined hazard mitigation activities and priorities to include scenarios for both present and future conditions. The final Mitigation Plan will be implemented through various projects, changes in day-to-day city operations, and through continued hazard mitigation development.

Planning Process Phases*

Throughout the project, the City followed its traditional approach to developing policy documents, including preparation of the First Draft Plan, review by the Planning Team. Then making the Second Draft Plan available to the public and external agencies via the City's website. Comments from the review were discussed by the Planning Team and incorporated into a Third Draft Plan. At that point, the Third Draft Plan was ready for notice and distribution in advance of the City Council meeting. Following adoption by the City Council, the Final Draft Plan was forwarded to Cal OES for review and approval by FEMA. The final step in the plan writing process was addressing minor issues raised during the Cal OES/FEMA review/approval. The resulting document is referred to as the Final Plan.

PLANNING PHASES				
Plan Writing Phase (First Draft Plan)	**Plan Review Phase (Second Draft Plan)**	**Plan Adoption Phase (Third Draft Plan)**	**Plan Approval Phase (Final Draft Plan)**	**Plan Implementation Phase**
• Planning Team input – research, meetings, writing, review of First Draft Plan • Revised accordingly to create Second Draft Plan	• Second Draft Plan made available via the City's website to the public and invited external agencies • Incorporate comments into the Third Draft Plan	• Public notice of City Council public meeting • Third Draft Plan was distributed to the City Council in advance of meeting as well as posted on the City's website. • Present Third Draft Plan to the City Council • City Council Adopted Plan • Incorporate input from City Council public meeting into Final Draft Plan	• Submit Final Draft Plan to Cal OES for joint review and approval by FEMA • Address any justified revisions identified by Cal OES or FEMA • Receive FEMA approval	• Conduct Planning Team meetings • Integrate mitigation action items into budget, CIP and other funding and strategic documents

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* **ELEMENT A: PLANNING PROCESS | A3**

A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))

Public Input*

The Plan was available to the public through different venues and will engage the public, involve them in ongoing planning and evaluation, and facilitate communication. The Planning Team recognized that community involvement increases the likelihood that hazard mitigation will become a standard consideration in the City's evolution. In that regard, the Planning Team advertised the availability of the Second Draft Mitigation Plan to the public and to external agencies with an interest in mitigation planning.

Only minor typographical changes were gathered from external agencies during the review of the Second Draft Plan. No comments were gathered from the public. The typographical changes were incorporated into the Third Draft Plan.

Participating Organizations

For mitigation planning to be successful; like all community planning; it requires collaboration with, and support from, federal, state, local, and regional governments; citizens; the private sector; universities; and non-profit organizations. The Planning Team consulted a variety of sources to ensure that the planning process results in practicable actions tailored to local needs and circumstances. Also, a variety of external organizations were involved in reviewing the draft Mitigation Plan in advance of the City Council public meeting.

City of Whittier and Hazard Mitigation

The potential impact of hazards associated with the City's location and varying terrain make the environment and population vulnerable to natural disaster situations. The City of Whittier is subject to earthquakes, floods, wildfires, and droughts. Any disaster scenario can only be assessed through careful planning and collaboration between public agencies, private sector organizations, and City residents, to make it possible to minimize loss.

The City of Whittier was incorporated in 1898 and since then, residents have experienced numerous disasters and hazardous conditions. Photographs, diaries and newspapers demonstrate that residents of the area have experienced earthquakes, flooding, wildfires, and drought.

While Whittier was sparsely populated, the hazards adversely affected the lives of the residents who depended on the land and climate conditions for food and welfare. Today, as the population density within the City of Whittier continues to increase, the exposure to natural hazards creates a greater risk than previously experienced.

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Mitigation Planning

As the cost of damage from disasters continues to increase nationwide, the City of Whittier recognizes the importance of identifying effective ways to reduce vulnerability to disasters. Mitigation Plans assist communities in reducing risk from hazards by identifying resources,

* **ELEMENT A: PLANNING PROCESS | A3**
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))

information, and strategies for risk reduction, while helping to guide and coordinate mitigation activities throughout the City.

The Plan provides a set of action items to reduce risk from hazards such as education and outreach programs and the development of partnerships. The Plan also provides for the implementation of preventative activities, including programs that restrict and control development in areas subject to damage from hazards.

The resources and information within the Mitigation Plan:

1. Establish a basis for coordination and collaboration among agencies and the public in the City of Whittier.
2. Identify and prioritize future mitigation projects; and
3. Assist in meeting the requirements of federal assistance programs.

The Mitigation Plan is integrated with other City plans including the Whittier Emergency Operations Plan, Whittier General Plan, the Capital Improvement Plan (CIP), as well as department-specific standard operating procedures.

Mitigation Plan Jurisdiction and Scope

The City's Mitigation Plan affects the areas within the City boundaries, with emphasis on City owned facilities and land. This Plan provides a framework for planning for natural hazards. The resources and background information in the plan address existing and future land development throughout the City of Whittier.

Risk Assessment

Risk assessment is the identification of risks posed by a hazard and the corresponding impacts to the community. This process involves five steps: identify hazards, profile hazards, inventory critical assets, assess risks, and assess vulnerability of future development.

Step 1: Identify Hazards

The Planning Team identified the hazards that could significantly impact the City by referencing the City's General Plan (including the 1993 Background Report and 2014 Housing Element), the State of California's Hazard Mitigation Plan, and the County of Los Angeles All-Hazard Mitigation Plan (2014).

The Planning Team ranked the hazards based on the probability, magnitude/severity, warning time, and duration. That analysis yielded the following hazards as posing the greatest risk to the City of Whittier: earthquakes, floods, wildfires, and drought.

Step 2: Profile Hazards

Hazard profiles determine the extent to which each hazard could impact the City. Each hazard profile contains the following information:

- ✓ Background and local conditions

- ✓ Historic frequency and probability of occurrence
- ✓ Severity
- ✓ Historic losses and impacts
- ✓ Designated hazard areas

Other factors considered include potential impact, onset, frequency, hazard duration, cascading effects, and recovery time for each hazard. Using this information, the Planning Team assessed the relative risk of each hazard ranging from severe risk to no risk. Where applicable, the source(s) of information, data, and maps showing vulnerable areas and relevant community components are provided.

Step 3: Inventory Critical Assets

Once hazards and profiles were established, locations of critical facilities were plotted and analyzed. To estimate losses from each hazard (number of structures, value of structures and number of people), the Planning Team used local resources; Census data; Hazards U.S.-Multi-Hazard (HAZUS-MH), a Geographic Information System (GIS) risk assessment methodology; and other GIS capabilities.

The inventory of assets shows a range of resources that could be lost or damaged for each hazard such as population, general building stock (residential and commercial), critical facilities (hospitals, police and fire stations, and transportation systems), and utilities.

Step 4: Assess Risks

Estimated losses to structures and their contents, as well as the losses to structure use and function, were identified (as data was available).

Step 5: Vulnerability Analysis of Future Development

This step provides a general description of City facilities and contents in relation to the identified hazards so that mitigation options can be considered in land use planning and future land use decisions. This Mitigation Plan provides comprehensive description of the character of the City of Whittier in Section 2: Community Profile. This description includes the geography and environment, population and demographics, land use and development, housing and community development, employment and industry, and transportation and commuting patterns. Analyzing these components of the City of Whittier helps to identify potential problem areas and serves as a guide for incorporating the goals and ideas contained in this mitigation plan into other community development plans.

Mitigation Goals

The risk assessment and public input involved a review of past mitigation actions, future goals, and appropriate mitigation strategies. The Planning Team identified five mitigation goals that summarize the hazard reduction outcome the City wants to achieve:

- ✓ Protect Life and Property
- ✓ Enhance Public Awareness

- ✓ Preserve Natural Systems
- ✓ Encourage Partnerships and Implementation
- ✓ Strengthen Emergency Services

These goals guided the development and implementation of specific mitigation activities. Many of the mitigation objectives and action items come from current programs. Emphasis was placed on the effectiveness of the activities with respect to their estimated cost.

Plan Review

The First Draft Plan was distributed by Emergency Planning Consultants to the Planning Team for review and input. Following that review, the revisions and recommendations were incorporated into the Second Draft Plan. The public was informed of the availability of the Plan via the City's website. In addition emails were sent to external agencies announcing the City's desire for input on the Second Draft Plan. The Third Draft Plan was produced to incorporate input gathered during the initial public review. The Third Draft Plan was posted again on the City's website along with official notice of the City Council meeting.

The list of external agencies invited to review the plan is an attachment in Section 10: Planning Process along with their input.

Plan Adoption*

The 2016 Mitigation Plan was presented to City Council for adoption on November 10, 2015. A copy of the City Council Resolution is located in Section 10: Planning Process.

Plan Approval

Following incorporation of input from the City Council, the Final Draft Plan was forwarded to Cal OES for review and approval by FEMA. FEMA issued an approval on October 27_, 2016.

Point of Contact

To request information or provide comments regarding this Mitigation Plan, please contact:

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* **ELEMENT E: PLAN ADOPTION | E1**

E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))

Plan Maintenance

Mitigation planning is an ongoing process involving changes as new hazards occur, as the area develops, and as more is learned about hazards and their impacts. The Planning Team will monitor changing conditions, help implement mitigation activities, annually review the plan to determine if City goals are being met, and provide an update to Cal OES and FEMA every five years. In addition, the Planning Team will review After-Action Reports generated after any disaster that impacts the City, and revise the mitigation plan, as needed.

Section 1: Introduction

City of Whittier is located in Los Angeles County and offers the benefits of living in a Mediterranean type of climate. The City is characterized by the unique and attractive landscape that makes the area so popular. However, the potential impacts of natural hazards associated with the terrain make the environment and population vulnerable to natural disaster situations.

The City is subject to earthquakes, flooding, wildfires, and drought. It is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the City. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from these natural disasters.

Why Develop a Mitigation Plan?

As the costs of damage from disasters continue to increase, the City realizes the importance of identifying effective ways to reduce vulnerability to disasters. Mitigation plans assist communities in reducing risk from hazards by identifying resources, information, and strategies for risk reduction, while helping to guide and coordinate mitigation activities throughout the City.

The plan provides a set of action items to reduce risks from hazards through education and outreach programs and to foster the development of partnerships, and implementation of preventative activities such as land use programs that restrict and control development in areas subject to damage from hazards.

The resources and information within the Mitigation Plan:

- ✓ Establish a basis for coordination and collaboration among agencies and the public of City of Whittier;
- ✓ Identify and prioritize future mitigation projects; and
- ✓ Assist in meeting the requirements of federal assistance programs.

The Mitigation Plan works in conjunction with other City plans, including the City's General Plan, Emergency Operations Plan, and Capital Improvement Plan.

Although vulnerability to natural hazards is clear, it is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the City. However, with careful planning and collaboration among public agencies, private sector organizations, and citizens within the community, it is possible to minimize the losses that can result from these natural disasters. As the population of the region continues to increase, the exposure to hazards creates an even higher risk than previously experienced.

Mitigation Planning Process

The process for updating the Mitigation Plan started with identifying members for the Planning Team. Each team member represented different City department and specific divisions within those departments with a role in mitigation efforts. The Planning Team met and identified characteristics and consequences of natural hazards with significant potential to affect the City.

Hazard mitigation strategy and goals were developed by understanding the risk posed by the identified hazards. The group also determined hazard mitigation activities and priorities to include scenarios for both present and future conditions. The final Mitigation Plan will be implemented through various projects, changes in day-to-day city operations, and through continued hazard mitigation development.

Why Plan for Hazards in City of Whittier?

Hazards impact residents, businesses, property, the environment, and the economy of City of Whittier. Based on history and science, natural hazards have or could potentially expose the City to the financial and emotional costs of recovery. The risk associated with hazards increases as more people move to areas affected by hazards.

Even in those communities such as Whittier that are essentially "built-out" (i.e., have little or no vacant land remaining for development), population density continues to increase when existing lower density residential and non-residential development is replaced with medium and high density residential development projects.

The inevitability of hazards, and the growing population and activity within the City create an urgent need to develop strategies, coordinate resources, and increase public awareness to reduce risk and prevent loss from future hazard events. Identifying the risks posed by hazards, and developing strategies to reduce the impact of a hazard event can assist in protecting life and property of citizens and communities. Local residents and businesses can work together with the City to create a Mitigation Plan that addresses the potential impacts of hazard events.

Hazard Mitigation Legislation

Relevant hazard mitigation legislation and grants are highlighted below.

Hazard Mitigation Grant Program

In 1974, Congress enacted the Robert T. Stafford Disaster Relief and Emergency Act, commonly referred to as the Stafford Act. In 1988, Congress established the Hazard Mitigation Grant Program (HMGP) via Section 404 of the Stafford Act. Regulations regarding HMGP implementation based on the DMA 2000 were initially changed by an Interim Final Rule (44 CFR Part 206, Subpart N) published in the Federal Register on February 26, 2002. A second Interim Final Rule was issued on October 1, 2002.

The HMGP helps states and local governments implement long-term hazard mitigation measures for natural hazards by providing federal funding following a federal disaster declaration. Eligible applicants include state and local agencies, Indian tribes or other tribal organizations, and certain nonprofit organizations.

In California, the HMGP is administered by Cal OES. Examples of typical HMGP projects include:

- ✓ Property acquisition and relocation projects
- ✓ Structural retrofitting to minimize damages from earthquake, flood, high wind, wildfire, or other natural hazards
- ✓ Elevation of flood-prone structures
- ✓ Vegetative management programs, such as:
- ✓ Brush control and maintenance
- ✓ Fuel break lines in shrubbery
- ✓ Fire-resistant vegetation in potential wildland fire areas

Pre-Disaster Mitigation Program

The Pre-Disaster Mitigation Program (PDM) was authorized by §203 of the Stafford Act, 42 United States Code (USC), as amended by §102 of the DMA 2000. Funding is provided through the National Pre-Disaster Mitigation Fund to help state and local governments (including Indian tribal governments) implement cost-effective hazard mitigation activities that complement a comprehensive mitigation program.

In Fiscal Year 2009, two types of grants (planning and competitive) were offered under the PDM Program. Planning grants allocate funds to each state for Mitigation Plan development. Competitive grants distribute funds to states, local governments, and federally recognized Indian tribal governments via a competitive application process. FEMA reviews and ranks the submittals based on pre-determined criteria. The minimum eligibility requirements for competitive grants include participation in good standing in the National Flood Insurance Program (NFIP) and a FEMA-approved Mitigation Plan.
(Source: http://www.fema.gov/fima/pdm.shtm)

"Floods and hurricanes happen. The hazard itself is not the disaster – it's our habits, it's how we build and live in those areas…that's the disaster."

Craig Fugate, FEMA Director

Flood Mitigation Assistance Program

The Flood Mitigation Assistance (FMA) Program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101). Financial support is provided through the National Flood Insurance Fund to help states and communities implement measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP.

Three types of grants are available under FMA: planning, project, and technical assistance. Planning grants are available to states and communities to prepare Flood Mitigation Plans. NFIP-participating communities with approved Flood Mitigation Plans can apply for project grants to implement measures to reduce flood losses. Technical assistance grants in the amount of 10 percent of the project grant are available to the state for program administration. Communities that receive planning and/or project grants must participate in the NFIP.

Examples of eligible projects include elevation, acquisition, and relocation of NFIP-insured structures. (Source: http://www.fema.gov/fima/fma.shtm)

Disaster Mitigation Act of 2000

DMA 2000 (DMA 2000) was signed by President Clinton on October 30, 2000 (Public Law 106-390). Section 322 primarily deals with the development of Mitigation Plans. The Interim Final Rule for planning provisions (44 CFR Part 201) was published in the Federal Register twice: February 26, 2002 and October 1, 2002. The Mitigation Planning requirements are implemented via 44 CFR Part 201.6.

DMA 2000 was designed to establish a national program for pre-disaster mitigation, streamline disaster relief at the federal and state levels, and control federal disaster assistance costs. Congress believed these requirements would produce the following benefits:

- ✓ Reduce loss of life and property, human suffering, economic disruption, and disaster costs.
- ✓ Prioritize hazard mitigation at the local level with increased emphasis on planning and public involvement, assessing risks, implementing loss reduction measures, and ensuring critical facilities/services survive a disaster.
- ✓ Promote education and economic incentives to form community-based partnerships and leverage non-federal resources to commit to and implement long-term hazard mitigation activities.

Under DMA 2000 state and local government (each city, county, and special district), and tribal government must develop a Mitigation Plan to be eligible to receive HMGP funds. Every mitigation plan, which must be reviewed by the state and approved by FEMA, should address the following items:

- ✓ Plan Promulgation
- ✓ Planning Process including Public Involvement
- ✓ Hazard Identification and Risk Assessment
- ✓ Mitigation Strategy
- ✓ Plan Implementation and Maintenance Procedures
- ✓ Specific State Requirements

State and Federal Support

While local jurisdictions have primary responsibility for developing and implementing hazard mitigation strategies, they are not alone. Various state and federal partners and resources can help local agencies with mitigation planning.

Cal OES is the lead agency for mitigation planning support to local governments. In addition, FEMA offers grants, tools, and training.

The Mitigation Plan was prepared in accordance with the following regulations and guidance:

- ✓ DMA 2000 (Public Law 106-390, October 10, 2000)

- ✓ 44 CFR Parts 201 and 206, Mitigation Planning and Hazard Mitigation Grant Program, Interim Final Rule, October 1, 2002
- ✓ 44 CFR Parts 201 and 206, Mitigation Planning and Hazard Mitigation Grant Program, Interim Final Rule, February 26, 2002
- ✓ How-To Guide for Using HAZUS-MH for Risk Assessment, (FEMA 433), February 2004
- ✓ Mitigation Planning "How-to" Series (FEMA 386-1 through 9 available at: http://www.fema.gov/fima/planhowto.shtm)
  - ✓ Getting Started: Building Support For Mitigation Planning (FEMA 386-1)
  - ✓ Understanding Your Risks: Identifying Hazards and Estimating Losses (FEMA 386-2)
  - ✓ Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies (FEMA 386-3)
  - ✓ Bringing the Plan to Life: Implementing the Mitigation Plan (FEMA 386-4)
  - ✓ Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)
  - ✓ Integrating Historic Property and Cultural Resource Considerations into Mitigation Planning (FEMA 386-6)
  - ✓ Integrating Manmade Hazards Into Mitigation Planning (FEMA 386-7)
- ✓ Multi-Jurisdictional Mitigation Planning (FEMA 386-8)
- ✓ Using the Mitigation Plan to Prepare Successful Mitigation Projects (FEMA 386-9)
- ✓ State and Local Plan Interim Criteria Under the DMA 2000, July 11, 2002, FEMA
- ✓ Mitigation Planning Workshop For Local Governments-Instructor Guide, July 2002, FEMA
- ✓ Report on Costs and Benefits of Natural Hazard Mitigation, Document #294, FEMA
- ✓ LHMP Development Guide – Appendix A - Resource, Document, and Tool List for Local Mitigation Planning, December 2, 2003, Cal OES

HAZUS-MH uses Geographic Information System technology to produce detailed maps and analytical reports on physical damage to building stock, critical facilities, transportation systems, and utilities.

Hazards U.S. – Multi-Hazard

In 1997, FEMA developed a standardized model for estimating losses caused by an earthquake. Hazards U.S. (HAZUS) addressed the need for more effective national, state, and local planning and the need to identify areas that face the highest risk and potential for loss.

Hazards U.S. Multi-Hazard (HAZUS-MH) provides models to estimate potential losses from floods (coastal and riverine) and winds (hail, hurricane, tornado, tropical cyclone, and thunderstorm). HAZUS-MH applies engineering and scientific risk calculations developed by hazard and information technology experts to provide defensible damage and loss estimates. This methodology provides a consistent framework for assessing risk across a variety of hazards.

HAZUS-MH uses Geographic Information System technology to produce detailed maps and analytical reports on physical damage to building stock, critical facilities, transportation systems, and utilities. The damage reports cover induced damage (debris, fire, hazardous material, and

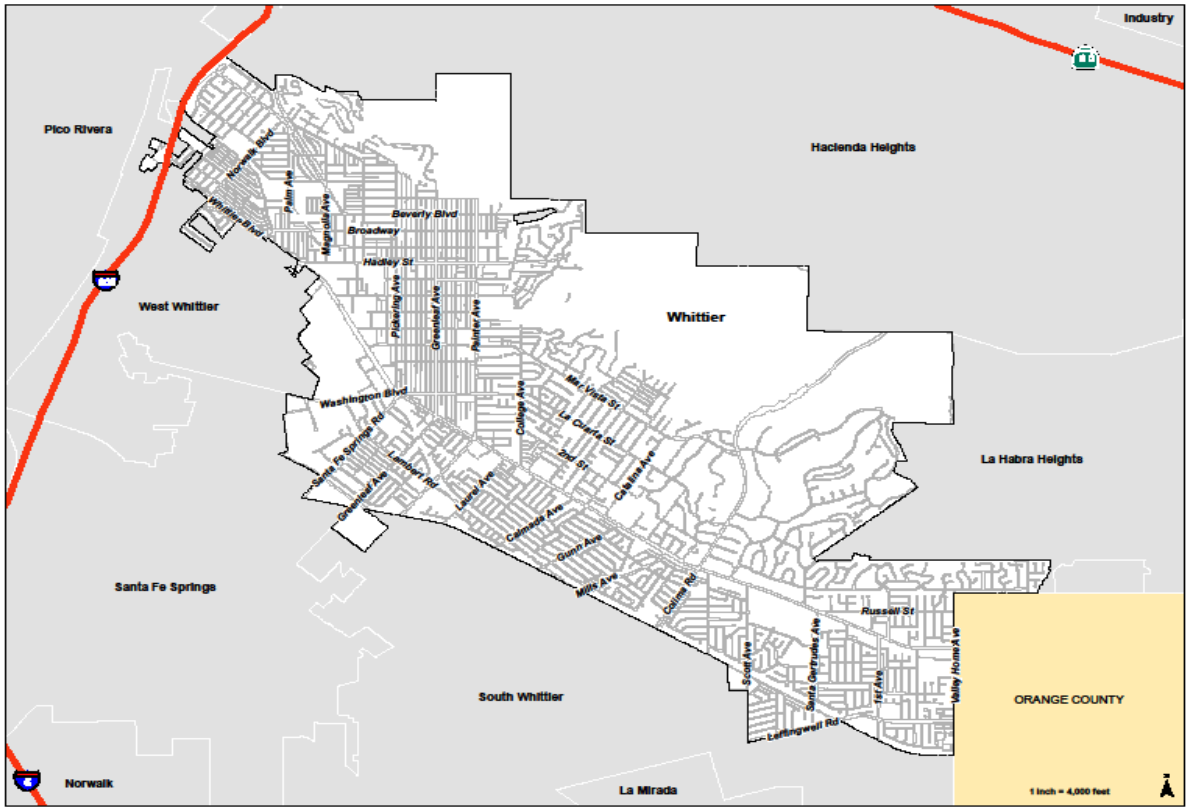
inundation) and direct economic and social losses (casualties, shelter requirements, and economic impacts), promoting standardization.

HAZUS maps and reports created by the County of Los Angeles are included in the Hazard-Specific Sections.

Who Does the Mitigation Plan Affect?

The Mitigation Plan affects the areas within the City of Whittier boundaries and City owned facilities and land. This plan provides a framework for planning for natural hazards. The resources and background information in the plan are applicable Citywide and to City-owned facilities outside of the City boundaries, and the goals and recommendations provide groundwork for local mitigation plans and partnerships. Map: City of Whittier shows the regional proximity of the City to its adjoining communities.

Map: City of Whittier
(Source: City of Whittier Community Development Department)



Section 2: Community Profile

Geography and the Environment

The City of Whittier has an area of 15.2 square miles and is located in southeastern Los Angeles County. It is located just south of the Puente Hills.

Information pertaining to the characteristics and features of the City of Whittier were gathered from a variety of sources including the City of Whittier's General Plan (including the Background Report and Housing Element), the City of Whittier's website, the County of Los Angeles All-Hazard Mitigation Plan, and a variety of web resources.

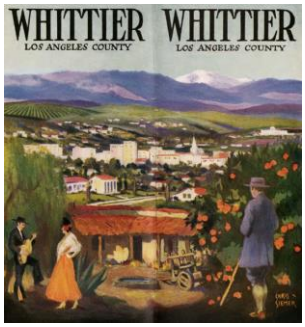
City of Whittier has an area of 15.2 square miles and is located in southeastern Los Angeles County. The City of Whittier borders the City of Hacienda Heights on the north, the City of Santa Fe Springs to the south, the City of Pico Rivera to the west, and the Cities of La Habra and La Habra Heights to the east. The average elevation of the City of Whittier is 365 feet. The Puente Hills are substantial rolling hills with a considerable amount of housing development in the northeast areas adjacent to the City. In the 1990's, the City acquired approximately 1500 acres in the Puente Hills in which no development is permitted. This development prohibition will definitely mitigate any structural loss in the event of a wildland fire.

(Whittier – late 19th Century)

History

The City of Whittier is one of the oldest cities in Los Angeles County and is rich in history. The area comprising the City of Whittier was first settled in 1887 as a Quaker colony and the city itself was incorporated in 1898.

The City is served by Whittier Boulevard (State Highway 72) running northwest to southeast through the City. The Santa Fe and Southern Pacific railroad serves the city with tracks in the southern area of the City.



Major Rivers

The nearest major river is the San Gabriel River. This River and water reservoirs on the hillsides have a potential minimal impact on the City of Whittier due to elevation of the City. Flooding of the San Gabriel River and severe damage to the flood control levee could inundate the City's Wellfield and Pumping Plant, which supply water to half the City. Although not a major river, Turnbull Canyon Creek channel presents the City's most likely scenario for flooding. There are Flood Zone A's directly below the Turnbull Canyon Creek debris basin. Worsham Creek also flows though the City of Whittier on a seasonal basis.

The San Gabriel River channel and Turnbull Canyon Creek debris basin are part of the County Flood Control District.

Climate

Temperatures in the City of Whittier average approximately 60 degrees in the winter months and 80 degrees in the summer months. However the temperatures can vary over a wide range, particularly when the Santa Ana winds blow, bringing higher temperatures and very low humidity.

Rainfall in the city averages 14.4 inches of rain per year. However the term "average rainfall" is misleading because over the recorded history of rain fall in the City of Whittier rainfall amounts have ranged dramatically from dry to wet years.

Furthermore, actual rainfall in Southern California tends to fall in large amounts during sporadic and often heavy storms rather than consistently over storms at somewhat regular intervals. In short, rainfall in Southern California might be characterized as feast or famine within a single year. Because the metropolitan basin is largely built out, water originating in higher elevation communities can have a sudden impact on adjoining communities that have a lower elevation.

Minerals and Soils

The characteristics of the minerals and soils present in City of Whittier indicate the potential types of hazards that may occur. Rock hardness and soil characteristics can determine whether

or not an area will be prone to geologic hazards such as earthquakes, liquefaction and landslides.

The surface material includes unconsolidated, fine-grained deposits of silt, sand, gravel, and recent flood plain deposits. Torrential flood events can introduce large deposits of sand and gravel. Sandy silt and silt containing clay are moderately dense and firm, and are primarily considered to be prone to liquefaction, an earthquake related hazard. Basaltic lava consists mainly of weathered and non-weathered, dense, fine-grained basalt. Though the characteristics of this lava may offer solid foundation support, landslides are common in many of these areas where weathered residual soil overlies the basalt. Understanding the geologic characteristics of City of Whittier is an important step in hazard mitigation and avoiding at-risk development.

Other Significant Geologic Features

The Elysian Park Fold Thrust Belt is located within the boundaries of Whittier and has the potential for surface fault rupture. Also, significant ground shaking can result from rupture of faults including Puente Hills and Whittier Fault.

The major faults that have the potential to affect Whittier are the:

- ✓ Whittier
- ✓ Puente Hills
- ✓ Elysian Park Fold Thrust Belt
- ✓ Newport-Inglewood
- ✓ Sierra Madre
- ✓ Palos Verdes
- ✓ San Jacinto
- ✓ San Andreas
- ✓ Norwalk

Southern California has a history of powerful and relatively frequent earthquakes, dating back to the powerful magnitude 8.0+ 1857 San Andreas Earthquake which did substantial damage to the relatively few buildings that existed at the time. Paleoseismological research indicates that large magnitude (8.0+) earthquakes occur on the San Andreas Fault at intervals between 45 and 332 years with an average interval of 140 years. Other lesser faults have also caused very damaging earthquakes since 1857. Notable earthquakes include the 1933 Long Beach Earthquake, the 1971 San Fernando Earthquake, the 1987 Whittier-Narrows Earthquake and the 1994 Northridge Earthquake.

In addition, many areas in the Los Angeles Basin have sandy soils that are subject to liquefaction. The City of Whittier has liquefaction zones in the northeastern and southeastern portions of the City as shown on USGS Seismic Hazard Maps.

The City of Whittier also has areas with land movement potential. Currently the city has active landslide activity in the northeast portion of the City. The hillside areas could potentially pose landslide and erosion hazards.

Population and Demographics

City of Whittier has a population of about 85,000 in an area of 15.2 square miles. The population of the City of Whittier has steadily increased from the late 1800's through 2000, and increased 12.9% from 1990 to 2000 according to the 2000 Census.

The increase of people living in City of Whittier creates more community exposure, and changes how agencies prepare for and respond to natural hazards. For example, more people living on the urban fringe can increase risk of fire. Wildfire has an increased chance of starting due to human activities in the urban/rural interface, and has the potential to injure more people and cause more property damage. An urban/wildland fire is not the only exposure to the City of Whittier. In the 1987 publication, *Fire Following Earthquake* issued by the All Industry Research Advisory Council, Charles Scawthorn explains how a post-earthquake urban conflagration would develop. The conflagration would be started by fires resulting from earthquake damage, but made much worse by the loss of pressure in the fire mains, caused by either lack of electricity to power water pumps, and /or loss of water pressure resulting from broken fire mains.

Furthermore, increased density can affect risk. For example, narrower streets are more difficult for emergency service vehicles to navigate, the higher ratio of residents to emergency responders affects response times, and homes located closer together increase the chances of fires spreading.

The City of Whittier is experiencing a great deal of in-fill building, which is increasing the population density creating greater service loads on the built infrastructure, including roads, water supply, sewer services and storm drains.

Hazards do not discriminate, but the impacts in terms of vulnerability and the ability to recover vary greatly among the population. According to Peggy Stahl of the Federal Emergency Management Agency (FEMA) Preparedness, Training, and Exercise Directorate, 80% of the disaster burden falls on the public, and within that number, a disproportionate burden is placed upon special needs groups: women, children, minorities, and the poor.

According the 2010 Census figures, the demographic makeup of the City is as follows:

Caucasian	28.3%
Hispanic	65.7%
African American	1.3%
Asian	3.8%
Native American	1.3%
Other	25.8%

(Source: www.City-Data.com)

The ethnic and cultural diversity suggests a need to address multi-cultural needs and services.

Although the percentage of poverty in City of Whittier (12.4%) is about 86% that of the state's (14.5%), 17.3% of the people living in poverty in City of Whittier are under 18 years old, and 10% are over 65. Vulnerable populations, including seniors, disabled citizens, women, and children, as well as those people living in poverty, may be disproportionately impacted by hazards.

Examining the reach of hazard mitigation policies to special needs populations may assist in increasing access to services and programs. FEMA's Office of Equal Rights addresses this need by suggesting that agencies and organizations planning for natural disasters identify special needs populations, make recovery centers more accessible, and review practices and procedures to remedy any discrimination in relief application or assistance.

The cost of hazards recovery can place an unequal financial responsibility on the general population when only a small proportion may benefit from governmental funds used to rebuild private structures. Discussions about hazards that include local citizen groups, insurance companies, and other public and private sector organizations can help ensure that all members of the population are a part of the decision-making processes.

Land and Development

Development in Southern California from the earliest days was a cycle of boom and bust. The Second World War however dramatically changed that cycle. Military personnel and defense workers came to Southern California to fill the logistical needs created by the war effort. The available housing was rapidly exhausted and existing commercial centers proved inadequate for the influx of people. Immediately after the war, construction began on the freeway system, and the face of Southern California was forever changed. Home developments and shopping centers sprung up everywhere and within a few decades the urbanized portions of Southern California were virtually built out. This pushed new development further and further away from the urban center.

The City of Whittier General Plan addresses the use and development of private land, including residential and commercial areas. This Plan is one of the City's most important tools in addressing environmental challenges including transportation and air quality; growth management; conservation of natural resources; clean water and open spaces.

The environment of most Los Angeles County cities is nearly identical with that of their immediate neighbors and the transition from one incorporated municipality to another is seamless to most people. Seamless too are the exposures to the hazards that affect all of Southern California.

Housing and Community Development

The City of Whittier is a mature urban community. Only a small portion of the City remains vacant and undeveloped. Residential land uses account for the majority of land uses with over three-fourths of the residential development devoted to single-family homes.

Commercial areas are found along Whittier Boulevard and in the original City center – Uptown Whittier. Industrial uses are found on the western section of the City along Whittier Boulevard. Public and institutional uses include schools, parks, libraries, hospitals, the Civic Center, and the landfill. The pattern of development in the City reflects a time predating the automobile.

The population of the City of Whittier has shown modest growth during the past few decades and, in fact, much of the growth has resulted from the expansion of the City boundaries (i.e. annexation).

Future development in Whittier must be sensitive to the presence of the Whittier fault on the northeastern section of the City. Also, very little land remains undeveloped, except for the hillside areas. Other concerns on future development include the age and capacity of existing infrastructure (water lines, sewer lines, storm drainage, etc.) to handle additional loads. The City is continuously upgrading infrastructure facilities to meet current demands.

The City seeks to maintain the character of existing residential neighborhoods and to revitalize underutilized commercial and industrial uses. A healthy balance of land uses can promote land use compatibility, economic development and the need for quality development.

The Puente Hills is a major concern for residents. Most of the hills are outside the City's corporate boundaries, but within the City's sphere of influence. The Hills provide aesthetic, safety, ecological and open space values to the City. The City desires to actively participate in future planning efforts for the Hills and to explore ways to preserve them.

The City's sphere of influence includes areas which represent opportunities for joint planning. These opportunities include the Puente Hills, the Los Nietos community and adjacent unincorporated county areas. The City will continue to explore its options in annexing the areas within its designated sphere of influence. (Source: City of Whittier General Plan Land Use Element)

In the City of Whittier the demand for housing outstrips the available supply, and the recent low interest rates have further fueled a pent up demand. Currently there are 28,526 housing units in the City of Whittier. There are 18,483 single family homes (64.8% of available housing units) currently available. As for multiple unit homes, they account for 35.2 % of the total existing housing units at 10.133, units. There are 15,525 owner occupied units in the City of Whittier and 11,679 renter occupied units. Approximately 42.9% of the units are being rented in Whittier and 57.1% of the units are owned. The median value of home prices decreased from $512,400 in 2010 to $418,500 in 2013.

Employment and Industry

According to the 2013 Census, Management (35.2%), sales and office occupations (29.8%), as well as production, transportation, and material moving (12.3%) are City of Whittier's principal employment activities. Educational, health and social services (23.1%), manufacturing (11%), and retail trade (12.1%) make up the major industries in the City of Whittier. The City of Whittier has a labor force of 43,259 persons, about 0.85% of the countywide workforce.

Mitigation activities are needed at the business level to ensure the safety and welfare of workers and limit damage to industrial infrastructure. Employees are highly mobile, commuting from surrounding areas to industrial and business centers. This creates a greater dependency on roads, communications, accessibility and emergency plans to reunite people with their families. Before a hazard event, large and small businesses can develop strategies to prepare for hazards, respond efficiently, and prevent loss of life and property.

Transportation and Commuting Patterns

Private automobiles are the dominant means of transportation in Southern California and in the City of Whittier. According to the City's General Plan, the City of Whittier meets its public

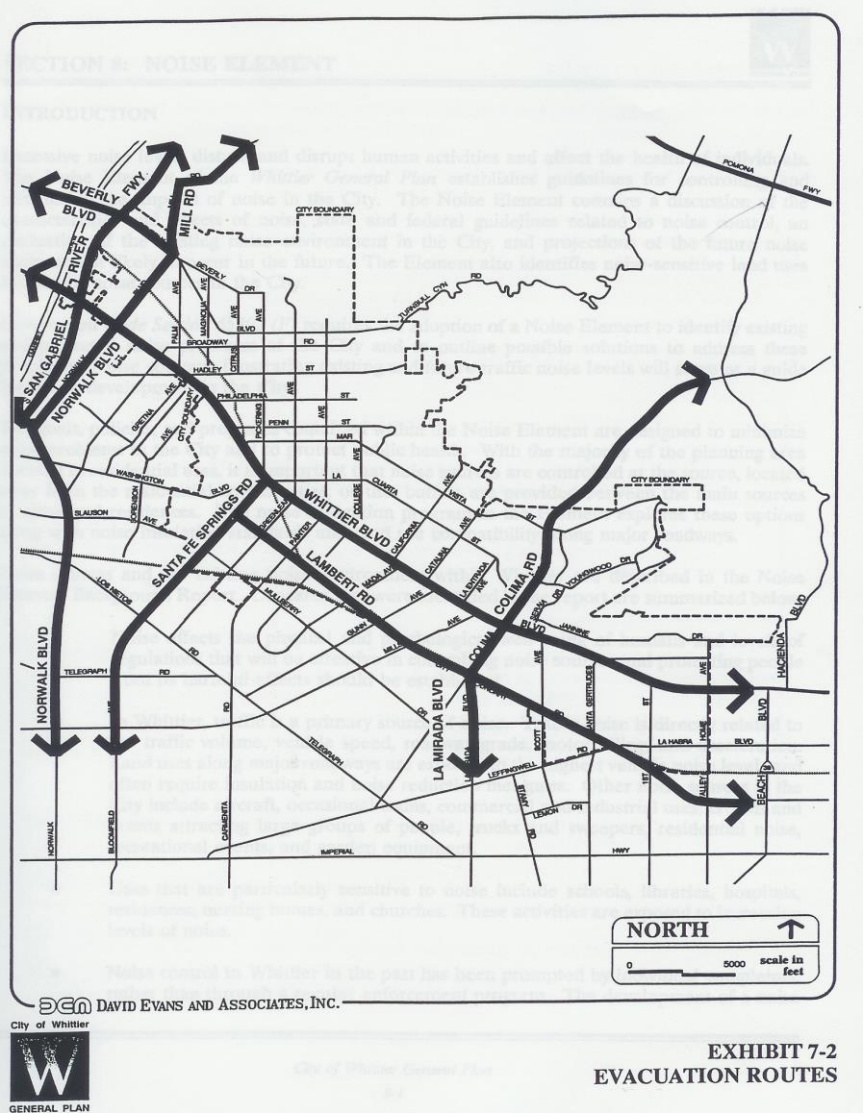
transportation needs through dial-a-ride, Whittier Transit fixed route system, links to light rail transit, and MTA buses. MTA provides bus and service to the City of Whittier and to the Los Angeles County metropolitan area. Montebello Transit and Norwalk Transit provide Whittier residents with transportation to nearby Metrolink stations in Montebello and Norwalk. In addition to these services, the City promotes alternative transportation activities including carpools and park-and-ride.

According to the 2010 Census, the City has a population of 85,000 and a daytime population estimated at around 86,000. The mean travel time to work for the residents of the City of Whittier age 16 years+ is 29.8 minutes. There are 592,000 vehicle trips per day in the entire City of Whittier. Approximately 56% of this is residential use and 44% generated primarily by non-residential uses.

According to the General Plan, the City of Whittier is served by Whittier Boulevard (State Highway 72) and 605, connecting the city to adjoining parts of Los Angeles County. The City's 198 mile road system includes 41 miles of arterial highways and 157 miles of local roads, and 15 “bridges,” as defined by Los Angeles County. As daily transit rises, there is an increased risk that a natural hazard event will disrupt the travel plans of residents across the region, as well as local, regional and national commercial traffic.

Localized flooding can render roads unusable. A severe winter storm has the potential to disrupt the daily driving routine of hundreds of thousands of people. Natural hazards can disrupt automobile traffic and shut down local and regional transit systems.

Map: City of Whittier Evacuation Routes
(Source: City of Whittier General Plan)
Routes have been designated based on size and flow of streets



Part II: HAZARD ANALYSIS

Section 3: Risk Assessment

What is a Risk Assessment?

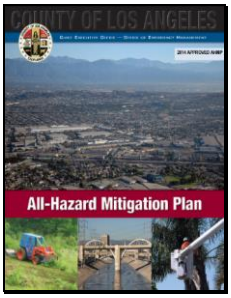
Conducting a risk assessment can provide information regarding: the location of hazards; the value of existing land and property in hazard locations; and an analysis of risk to life, property, and the environment that may result from natural hazard events. Specifically, the five levels of a risk assessment are as follows:

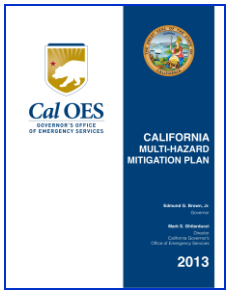
1. *Hazard Identification*
2. *Profiling Hazard Events*
3. *Vulnerability Assessment/Inventory of Existing Assets*
4. *Risk Analysis*
5. *Assessing Vulnerability/Analyzing Development Trends*

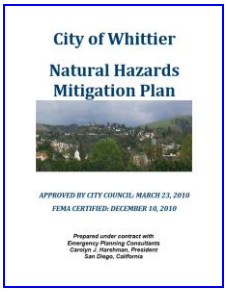
1) Hazard Identification

This section is the description of the geographic extent, potential intensity, and the probability of occurrence of a given hazard. Maps are used in this plan to display hazard identification data. The City of Whittier utilized the categorization of hazards as identified in California's State Hazard Mitigation Plan, including: Earthquakes, Floods, Levee Failures, Wildfires, Landslides and Earth Movements, Tsunami, Climate-Related Hazards, Volcanoes, and Other Hazards.

The Planning Team reviewed existing documents (i.e. City of Whittier General Plan, Los Angeles County Mitigation Plan, City of Whittier Emergency Operations Plan, and previous Mitigation Plan) to determine which of these hazards posed the most significant threat to the City. In other words, which hazard would likely result in a local declaration of emergency.







The geographic extent of each of the identified hazards was identified by the Planning Team utilizing maps and data contained in the City's General Plan (including the Background Report and Housing Element) and City's Emergency Operations Plan. In addition, numerous internet resources and the County of Los Angeles Hazard Mitigation Plan served as valuable resources.

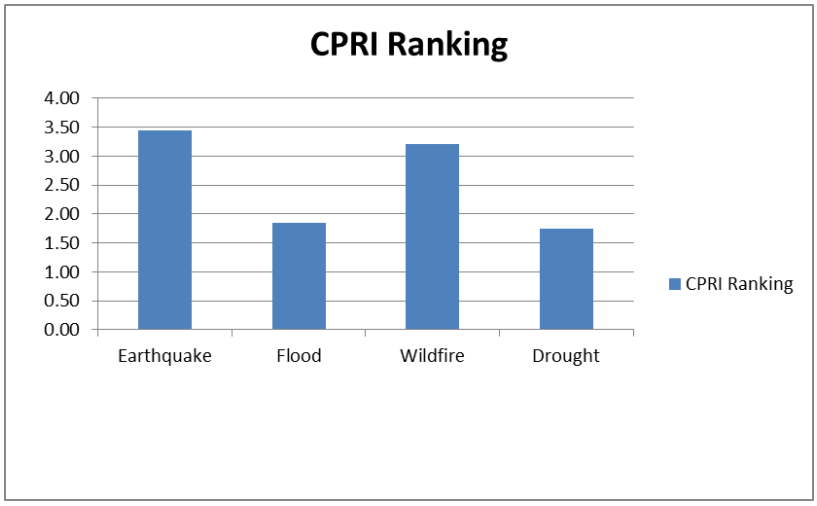
Utilizing the Calculated Priority Risk Index (CPRI) ranking technique, the Planning Team concluded that four hazards posed the most significant threat against the City: earthquakes, floods (including dam failure), wildfires, and drought. The hazard ranking system is described in Table: Calculated Priority Risk Index, while the actual ranking is shown in Table: Calculated Priority Risk Index Ranking for City of Whittier.

Table: Calculated Priority Risk Index
(Source: Federal Emergency Management Agency)

CPRI Category	Degree of Risk			Assigned Weighting Factor
	Level ID	Description	Index Value	
Probability	Unlikely	Extremely rare with no documented history of occurrences or events. Annual probability of less than 1 in 1,000 years.	1	45%
	Possibly	Rare occurrences. Annual probability of between 1 in 100 years and 1 in 1,000 years.	2	
	Likely	Occasional occurrences with at least 2 or more documented historic events. Annual probability of between 1 in 10 years and 1 in 100 years.	3	
	Highly Likely	Frequent events with a well-documented history of occurrence. Annual probability of greater than 1 every year.	4	
Magnitude/ Severity	Negligible	Negligible property damages (less than 5% of critical and non-critical facilities and infrastructure. Injuries or illnesses are treatable with first aid and there are no deaths. Negligible loss of quality of life. Shut down of critical public facilities for less than 24 hours.	1	30%
	Limited	Slight property damage (greater than 5% and less than 25% of critical and non-critical facilities and infrastructure). Injuries or illnesses do not result in permanent disability, and there are no deaths. Moderate loss of quality of life. Shut down of critical public facilities for more than 1 day and less than 1 week.	2	
	Critical	Moderate property damage (greater than 25% and less than 50% of critical and non-critical facilities and infrastructure). Injuries or illnesses result in permanent disability and at least 1 death. Shut down of critical public facilities for more than 1 week and less than 1 month.	3	
	Catastrophic	Severe property damage (greater than 50% of critical and non-critical facilities and infrastructure). Injuries and illnesses result in permanent disability and multiple deaths. Shut down of critical public facilities for more than 1 month.	4	
Warning Time	> 24 hours	Population will receive greater than 24 hours of warning.	1	15%
	12–24 hours	Population will receive between 12-24 hours of warning.	2	
	6-12 hours	Population will receive between 6-12 hours of warning.	3	
	< 6 hours	Population will receive less than 6 hours of warning.	4	
Duration	< 6 hours	Disaster event will last less than 6 hours	1	10%
	< 24 hours	Disaster event will last less than 6-24 hours	2	
	< 1 week	Disaster event will last between 24 hours and 1 week.	3	
	> 1 week	Disaster event will last more than 1 week	4	

Table: Calculated Priority Risk Index Ranking for City of Whittier

Hazard	Probability	Weighted 45% (x.45)	Magnitude Severity	Weighted 30% (x.3)	Warning Time	Weighted 15% (x.15)	Duration	Weighted 10% (x.1)	CPRI Totals
Earthquake (Whittier/Puente Hills Fault)	3	1.35	4	1.2	4	0.6	3	0.3	**3.45**
Flood (Turnbull Canyon, Creek Canyon)	2	0.9	1	0.3	3	0.45	2	0.2	**1.85**
Wildfire (Turnbull Canyon, Creek Canyon)	4	1.8	2	0.6	4	0.6	2	0.2	**3.20**
Drought	4	1.8	1	0.3	1	0.15	4	0.4	**2.65**



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2) Profiling Hazard Events

This process describes the causes and characteristics of each hazard and what part of the City's facilities, infrastructure, and environment may be vulnerable to each specific hazard. A profile of each hazard discussed in this plan is provided in the Hazard-Specific Sections (Sections 4-7). Table: Vulnerability: Location, Extent, and Probability for City of Whittier indicates a generalized perspective of the community's vulnerability of the various hazards according to extent (or degree), location, and probability.

Table: Vulnerability: Location, Extent, and Probability for City of Whittier*†

Hazard	Location (Where)	Extent (How Big an Event)	Probability (How Often)*
Earthquake	Entire Project Area	The Southern California Earthquake Center (SCEC) in 2007 concluded that there is a 99.7 % probability that an earthquake of M6.7 or greater will hit California within 30 years.[1]	Moderate
Flood	Turnbull Canyon, Creek Canyon	Riverine Flooding: 100-year floodplain (Zone A)	Moderate
Wildfire	Northern Project Area	CAL FIRE FRAP Rating is "Very High"	Moderate
Drought	Entire Project Area	Residential, Commercial, Industrial, and Institutional Water Conservation	High
* Probability is defined as: Low = 1:1,000 years, Moderate = 1:100 years, High = 1:10 years			
[1] Uniform California Earthquake Rupture Forecast			

3) Vulnerability Assessment/Inventory of Existing Assets

This is a combination of hazard identification with an inventory of the existing (or planned) property development(s) and population(s) exposed to a hazard. Critical facilities are of particular concern because these locations provide essential equipment or provide services to the general public that are necessary to preserve important public safety, emergency response, and/or disaster recovery functions. The critical facilities have been identified and are illustrated in Table: City of Whittier Critical Facilities Vulnerable to Hazards.

4) Risk Analysis

Estimating potential losses involves assessing the damage, injuries, and financial costs likely to be sustained in a geographic area over a given period of time. This level of analysis involves using mathematical models. The two measurable components of risk analysis are magnitude of the harm that may result and the likelihood of the harm occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. For each hazard where data was available, quantitative estimates for potential losses have been included in the hazard assessment. Data was not available to make vulnerability determinations in terms of dollar losses for all of the

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* ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))
† ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

identified hazards. The Mitigation Actions Matrix (Section 8: Mitigation Strategies) includes an action item to conduct such an assessment in the future.

5) Assessing Vulnerability/ Analyzing Development Trends

This step provides a general description of City facilities and contents in relation to the identified hazards so that mitigation options can be considered in land use planning and future land use decisions. This Mitigation Plan provides comprehensive description of the character of the City in Section 2: Community Profile. This description includes the geography and environment, population and demographics, land use and development, housing and community development, employment and industry, and transportation and commuting patterns. Analyzing these components of the City can help in identifying potential problem areas and can serve as a guide for incorporating the goals and ideas contained in this mitigation plan into other community development plans.

Hazard assessments are subject to the availability of hazard-specific data. Gathering data for a hazard assessment requires a commitment of resources on the part of participating organizations and agencies. Each hazard-specific section of the plan includes a section on hazard identification using data and information from city, county, state, or federal sources.

Regardless of the data available for hazard assessments, there are numerous strategies the City can take to reduce risk. These strategies are described in the action items detailed in the Mitigation Actions Matrix (Section 8: Mitigation Strategies). Mitigation strategies can further reduce disruption to critical services, reduce the risk to human life, and alleviate damage to personal and public property and infrastructure.

Critical and Essential Facilities

Facilities critical to government response activities (i.e., life safety and property and environmental protection) include: local government 9-1-1 dispatch centers, local government emergency operations centers, local police and fire stations, local public works facilities, local communications centers, schools (shelters), and hospitals. Also, facilities that, if damaged, could cause serious secondary impacts are also considered "critical". A hazardous materials facility is one example of this type of critical facility.

Essential facilities are those facilities that are vital to the continued delivery of key City services or that may significantly impact the City's ability to recover from the disaster. These facilities include but are not limited to: schools (hosting shelters); buildings such as the jail, law enforcement center, public services building, community corrections center, the courthouse, and juvenile services building and other public facilities.

Table: Critical Facilities Vulnerable to Hazards illustrates the critical facilities within the City of Whittier and the vulnerability of those facilities to the identified hazards.

Table: Critical Facilities Vulnerable to Hazards

Name of Facility	Earthquake	Flood	Wildfire	Drought
City Hall 13230 Penn Street	X		X	X
Whittier Police Department 7315 Painter Avenue	X		X	X
City Yard 12016 Hadley Street	X	X		X
County of Los Angeles Fire Department - Station #17 12006 Hadley Street	X	X		X
County of Los Angeles Fire Department - Station #28 7733 Greenleaf Avenue	X			X
County of Los Angeles Fire Department - Station #59 10021 Scott Avenue	X			X
Presbyterian Intercommunity Hospital 12401 Washington Boulevard	X			X
Whittier Hospital Medical Center 9080 Colima Road	X		X	X

Land and Development

Development in Southern California from the earliest days was a cycle of boom and bust. The Second World War however dramatically changed that cycle. Military personnel and defense workers came to Southern California to fill the logistical needs created by the war effort. The available housing was rapidly exhausted and existing commercial centers proved inadequate for the influx of people. Immediately after the war, construction began on the freeway system, and the face of Southern California was forever changed. Home developments and shopping centers sprung up everywhere and within a few decades the urbanized portions of Southern California were virtually built out. This pushed new development further and further away from the urban center.

The City's General Plan provides the framework for the growth and development of the City, including, the use and development of private land, including residential, industrial and commercial areas, as demonstrated in the image below. This Plan is one of the City's most important tools in addressing environmental challenges including transportation and air quality; growth management; conservation of natural resources; clean water and open spaces.

The environment of most Los Angeles County cities is nearly identical with that of their immediate neighbors and the transition from one incorporated municipality to another is

seamless to most people. Consequently, many Los Angeles County communities are at-risk for the same natural hazards.

Impacts to Types of Structures

The City's General Plan identifies a broad range of land uses and the Building Code identifies several building types. In general terms, structures are categorized as residential, commercial, institutional, or public.

Table: Impacts to Existing and Future Types of Structures in the City of Whittier (Source: EPC analysis based on City of Whittier General Plan – Land Use Map)

Category of Structure	Earthquake	Flood	Wildfire	Drought
Single-Family Residential	X	X	X	X
Multi-Family Residential	X	X	X	X
Commercial	X	X	X	X
Institutional	X	X	X	X
Manufacturing	X	X		X
Educational Institutions	X	X	X	X
Uptown Whittier Historical Buildings	X	X	X	X

*Changes in Development**

Since the adoption of the 2010 Plan, there have been no significant alterations to the development pattern of the City in the hazard prone areas. This conclusion was reached after a thorough review of the General Plan and discussion with the Planning Team.

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* **ELEMENT D. MITIGATION STRATEGY | D1**
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))

Map: Land Use Plan Maps
(Source: City of Whittier General Plan 1993)

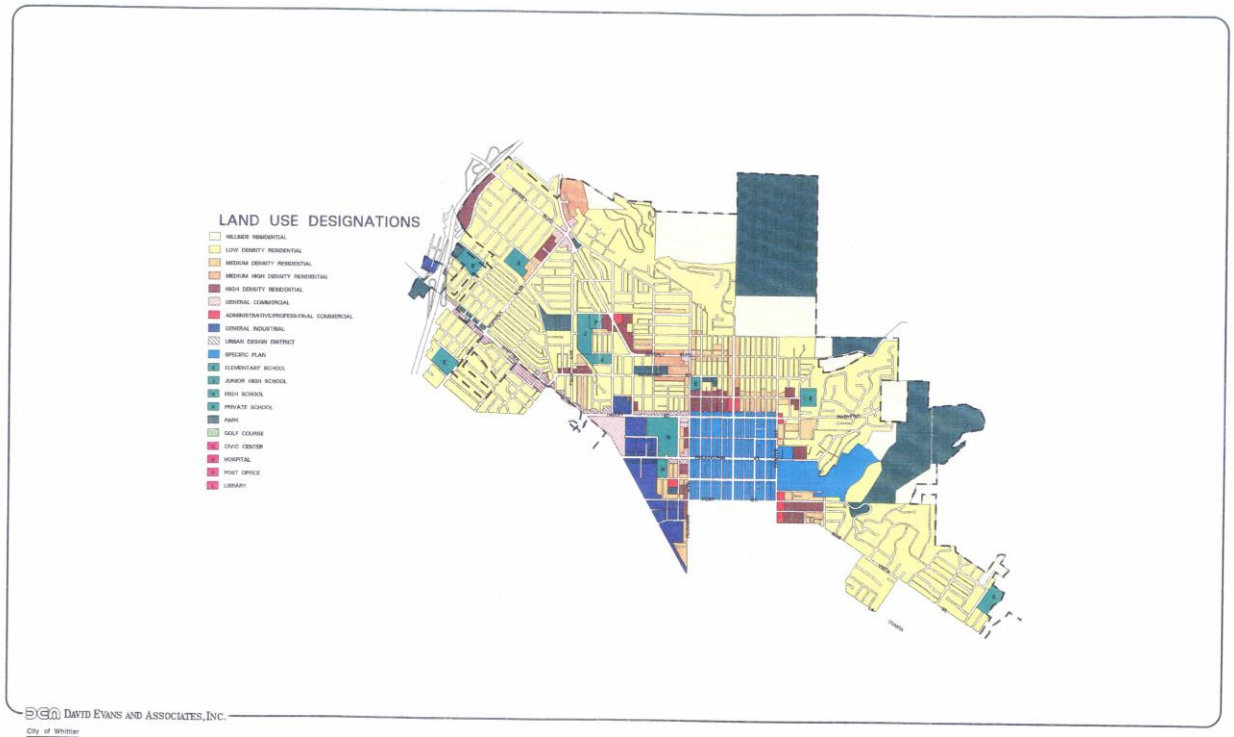
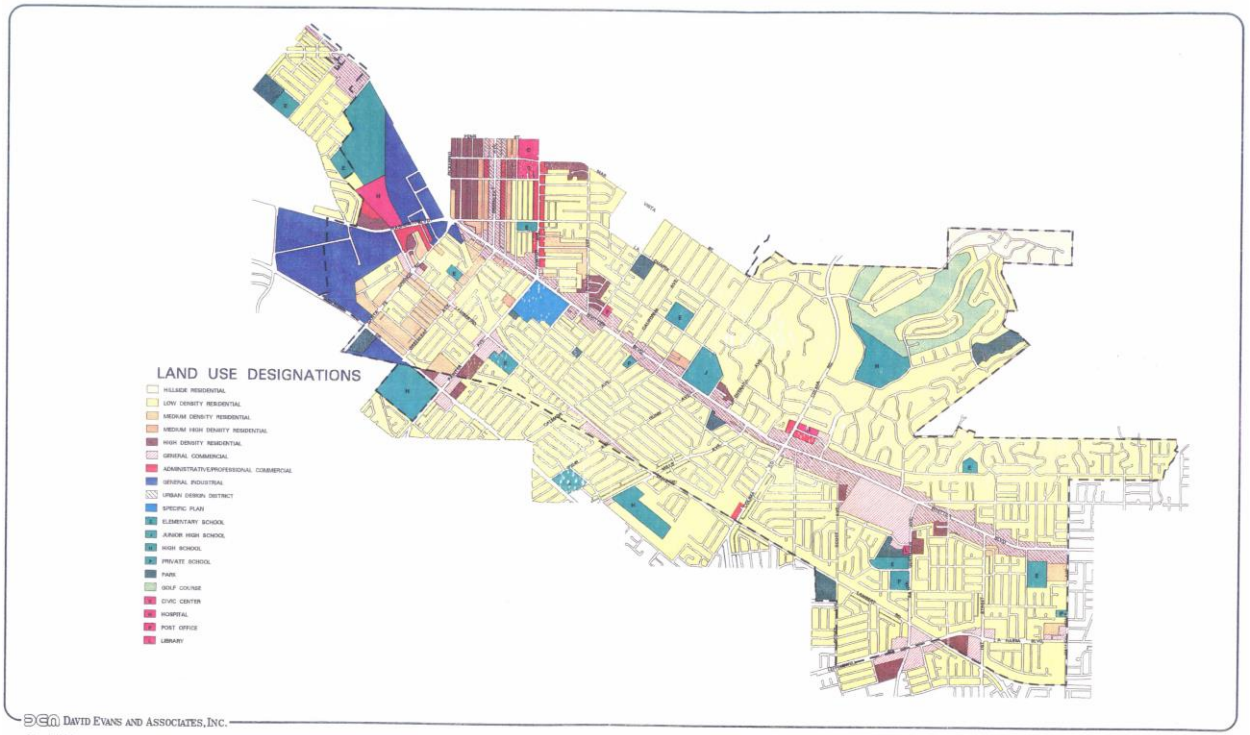


EXHIBIT 2-1
LAND USE PLAN
(NORTHWEST AREA)



City of Whittier
GENERAL PLAN

EXHIBIT 2-2
LAND USE PLAN
(SOUTHEAST AREA)

Integration with the General Plan

The goals and policies of the Public Safety Element respond to the different safety concerns that are present in the City. The policies established by the City are grouped together under five specific goals. These goals address overall protection from hazards, the provision of adequate safety services, protection from seismic hazards and the regulation of hazardous materials use and disposal. They are intended to prevent hazardous conditions, to protect residents from harm, and to prepare the City for unavoidable disasters.

Issue: Protection from Hazards

The protection of life and property from hazards is the major objective of the following goal and supporting policies. Future planning that takes into account the natural and manmade hazards in the City, will improve the level of safety for all residents.

Promote an environment that is reasonably safe from hazards so that Whittier residents may conduct their daily lives free from fear and apprehension.

Policy 1.1 Continue to work for the highest quality of fire, police, and health protection possible for all Whittier residents.

Policy 1.2 Continue to cooperate with public agencies and support service providers to develop emergency preparedness programs to reduce injury, loss of life, and property damage.

Policy 1.3 Continue to provide fast, efficient, and reliable assistance to disaster victims and to areas where conditions warrant evacuation of people and property.

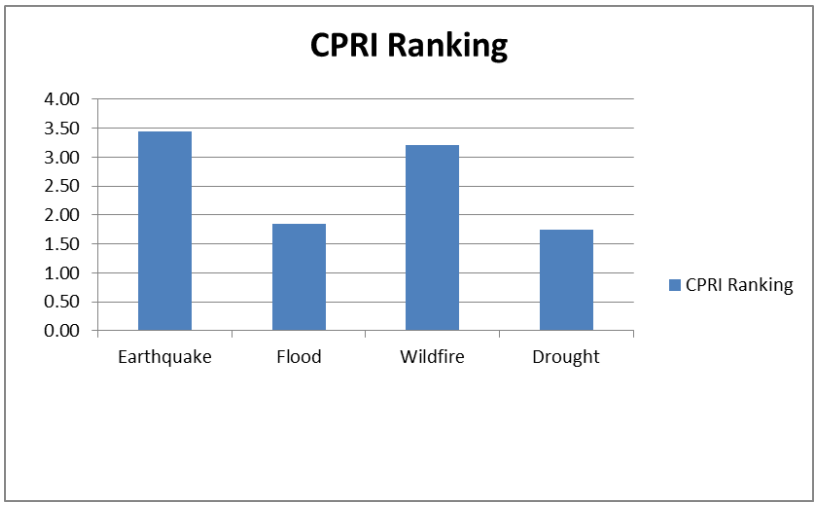
Policy 1.4 Promote emergency preparedness through public education and awareness programs on safety, earthquake preparedness, crime prevention, and fire and hazard prevention.

Policy 1.5 Promote the study, adoption, and review of regulations designed to assure appropriate and safe development in hazardous areas.

Summary

Natural hazard mitigation strategies can reduce the impacts concentrated at large employment and industrial centers, public infrastructure, and critical facilities. Hazard mitigation for industries and employers may include developing relationships with emergency management services and their employees before disaster strikes, and establishing mitigation strategies together. Collaboration among the public and private sector to create mitigation plans and actions can reduce the impacts of hazards.

Section 4: Earthquake Hazards



Previous Occurrences of Earthquakes in the City of Whittier*

Photo: Collapse of wall of second story of Art's Jewelry and Loan establishment on Greenleaf Avenue in "Uptown" Whittier
(Source: NOAA)

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* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2**

B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

The most significant earthquake event affecting Whittier was the October 1, 1987 Whittier Narrows Earthquake (Magnitude 6.1, which was later downgraded to 5.9), and the October 4, 1987 aftershock (Magnitude 5.5). The earthquake caused 8 deaths (not in Whittier) and extensive property damage, especially to older residential and commercial buildings. The damaged Uptown section of Whittier, with many unreinforced masonry buildings, was by far the area hardest hit. At least 200 residences and 30 businesses were badly damaged and most of the severe damage was to structures built before 1930.

However, the earthquakes both occurred either early in the morning or on a Sunday. This considerably reduced the potential effects. Many damaged buildings and streets were unoccupied, and most businesses were not yet open.

Since the writing of the 2010 Mitigation Plan, there have been no significant earthquake impacts on the City of Whittier.

Photo: Partial collapse of parking garage and store (Source: NOAA)

The earthquakes caused an estimated $358 million in property damage. Los Angeles County reports estimate that both earthquakes damaged over 9,100 residential and business structures throughout the county. Houses in Whittier were partially shaken from their foundations and countless chimneys were damaged. In Uptown Whittier, falling walls and bricks damaged many parked automobiles. Severe structural cracks within the foundation of the nearby interchange of Interstate Highways 5 and 605 caused CalTrans officials to close the interchange for the day for

temporary repairs. Small landslides could be observed in Turnbull Canyon in northern Whittier. Fortunately, the terrain was much too dry for the ground shaking to have activated deep-seated landslides. Dust clouds rose over the southern flank of the San Gabriel Mountains caused by rock falls and surface land sliding from road cuts.

These were the first damaging earthquakes to occur in the Los Angeles area since the 1971 San Fernando Earthquake (Magnitude 6.4). The next most recent significant earthquake affecting southern California was the January 1, 1994 Northridge Earthquake (Magnitude 6.7). Fifty-seven people were killed and more than 1,500 people were seriously injured. Approximately 15,000 structures were moderately to severely damaged, which left thousands of people temporarily homeless. Several collapsed bridges and overpasses created commuter havoc on the freeway system. The Northridge Earthquake resulted in record economic losses.

Historical and geological records show that California has a long history of seismic events. Southern California is probably best known for the San Andreas Fault, a 400 mile long fault running from the Mexican border to a point offshore, west of San Francisco. "Geologic studies show that over the past 1,400 to 1,500 years large earthquakes have occurred at about 130 year intervals on the Southern San Andreas Fault. As the last large earthquake on the Southern San Andreas occurred in 1857, that section of the fault is considered a likely location for an earthquake within the next few decades."

The San Andreas is only one of dozens of known earthquake faults that crisscross Southern California. Some of the better known faults include the Newport-Inglewood, Whittier, Chatsworth, Elsinore, Hollywood, Los Alamitos, Puente Hills, and Palos Verdes Faults. Beyond the known faults, there are a potentially large number of "blind" faults that underlie the surface of Southern California. One such blind fault was involved in the October 1987 Whittier Narrows Earthquake.

Although the most famous of the faults, the San Andreas, is capable of producing an earthquake with a moment magnitude of greater than 8, some of the "lesser" faults have the potential to inflict greater damage on the urban core of Southern California.

Tremendous earthquake mapping and mitigation efforts have been made in California in the past two decades, and public awareness has risen remarkably during this time. Major federal, state, and local government agencies and private organizations support earthquake risk reduction, and have made significant contributions in reducing the adverse impacts of earthquakes. Despite the progress, the majority of California communities remain unprepared because there is a general lack of understanding regarding earthquake hazards among Californians.

Earthquake Characteristics

A recent Southern California Earthquake Center (SCEC) report (SCEC, 1995) indicated that the probability of an earthquake of Magnitude 7 or larger in southern California before the year 2024 is 80 to 90%. A significant earthquake along one of the major faults could cause substantial casualties, extensive damage to buildings, roads and bridges, fires, and other threats to life and property. The effects could be aggravated by aftershocks and by secondary effects such as fire, landslides and dam failure. A major earthquake could be catastrophic in its effect on the population, and could exceed the response capability of the local communities and even the State.

Following major earthquakes, extensive search and rescue operations may be required to assist trapped or injured persons. Emergency medical care, food and temporary shelter would be required for injured or displaced persons. In the event of a truly catastrophic earthquake, identification and burial of the dead would pose difficult problems. Mass evacuation may be essential to save lives, particularly in areas below dams. Many families could be separated, particularly if the earthquake should occur during working hours, and a personal inquiry or locator system would be essential to maintain morale.

Emergency operations could be seriously hampered by the loss of communications and damage to transportation routes within, and to and from, the disaster area and by the disruption of public utilities and services.

Extensive federal assistance could be required and could continue for an extended period. Efforts would be required to remove debris and clear roadways, demolish unsafe structures, assist in reestablishing public services and utilities, and provide continuing care and welfare for the affected population, including temporary housing for displaced persons.

In general, the population is less at risk during non-work hours (if at home) as wood-frame structures are relatively less vulnerable to major structural damage than are typical commercial and industrial buildings. Transportation problems are intensified if an earthquake occurs during work hours, as significant numbers of employees would be stranded in the City. An earthquake occurring during work hours would clearly create major transportation problems for those displaced workers.

Regulatory Background

The State regulates development within California to reduce or mitigate potential hazards from earthquakes or other geologic hazards. Development in potentially seismically active areas is also governed by the Alquist-Priolo Earthquake Fault Zoning Act and the Seismic Hazards Mapping Act.

Chapter 16A, Division IV of the California Building Code (CBC), titled “Earthquake Design.” states that “The purpose of the earthquake provisions herein is primarily to safeguard against major structural failures or loss of life.” The CBC and the Uniform Building Code (UBC) regulate the design and construction of excavations, foundations, building frames, retaining walls, and other building elements to mitigate the effects of seismic shaking and adverse soil conditions. The procedures and limitations for the design of structures are based on site characteristics, occupancy type, configuration, structural system, height, and seismic zonation. Seismic zones are mapped areas (Figure 16A-2 of the CBC and Figure 16-2 of the UBC) that are based on proximity to known active faults and the potential for future earthquakes and intensity of seismic shaking. Seismic zones range from 0 to 4, with areas mapped as Zone 4 being potentially subject to the highest accelerations due to seismic shaking and the shortest recurrence intervals. The City of Whittier is located within Seismic Zone 4.

Historical Events in Los Angeles County

Southern California has a history of powerful and relatively frequent earthquakes, dating back to the powerful magnitude 8.0+ 1857 San Andreas Earthquake which did substantial damage to the relatively few buildings that existed at the time.

Paleseismological research indicates that large magnitude (8.0+) earthquakes occur on the San Andreas Fault at intervals between 45 and 332 years with an average interval of 140 years. Other lesser faults have also caused very damaging earthquakes since 1857. Notable earthquakes include the 1933 Long Beach Earthquake, the 1971 San Fernando Earthquake, the 1987 Whittier Earthquake and the 1994 Northridge Earthquake.

The most recent significant earthquake event affecting Southern California was the January 17th 1994 Northridge Earthquake. At 4:31 A.M. on Monday, January 17th, a moderate but very damaging earthquake with a magnitude of 6.7 struck the San Fernando Valley. In the following days and weeks, thousands of aftershocks occurred, causing additional damage to affected structures.

Fifty-seven people were killed and more than 1,500 people seriously injured. For days afterward, thousands of homes and businesses were without electricity; tens of thousands had no gas; and nearly 50,000 had little or no water. Approximately 15,000 structures were moderately to severely damaged, which left thousands of people temporarily homeless; 66,500 buildings were inspected. Nearly 4,000 were severely damaged and over 11,000 were moderately damaged. Several collapsed bridges and overpasses created commuter havoc on the freeway system. Extensive damage was caused by ground shaking, but earthquake triggered liquefaction and dozens of fires also caused additional severe damage. This extremely strong ground motion in large portions of Los Angeles County resulted in record economic losses.

Since seismologists started recording and measuring earthquakes, there have been tens of thousands of recorded earthquakes in Los Angeles County, most with a magnitude below three. No community in Los Angeles County is beyond the reach of a damaging earthquake. Table: 4-2: Earthquake Events in the Los Angeles County describes the historical earthquake events that have affected Los Angeles County. Based on a search of earthquake databases of the United States Geological Survey (USGS) - National Earthquake Information Center (NEIC), several major earthquakes (Magnitude 6.0 or more) have been recorded within approximately 100 kilometers of the project area since 1769.

Table: Earthquake Events in Los Angeles County (Magnitude 5.0 or Greater) (Source: http://www.usgs.gov/)

1769	Los Angeles Basin	1910	Glen Ivy Hot Springs
1812	Wrightwood	1987	Whittier Narrows
1827	Los Angeles Region	1992	Landers
1855	Los Angeles Region	1994	Northridge
1893	Pico Canyon	2005	Southern California
2014	La Habra		

Faults are prevalent throughout California and are commonly classified as either “active” or “potentially active.” An active fault is a break that has moved in recent geologic time (the last 11,000 years) and that is likely to move within the next approximately 100 years. Active faults are the primary focus of concern in attempting to prevent earthquake hazards. A potentially active fault is one that has shifted but not in the recent geologic period (or, between 11,000 and 3,000,000 years ago) and is therefore considered dormant or unlikely to move in the future. Several active faults have been identified within or adjacent to the boundaries of the Whittier planning area, which, most importantly, indicates that the community falls under the State Earthquake Fault Zoning Act and the State Hazards Mapping Act. These Acts basically require that local governments, in the general plan update process, adopt policies and criteria to ensure the structural adequacy of buildings erected across active faults for human occupancy. In some cases, the development of structures must be prohibited. Verification that the above Acts pertain to Whittier was obtained through correspondence with the State Department of Conservation and is on file with the City’s Planning Services Division.

According to the City’s Background Report to the General Plan (1993), several seismic conditions (e.g. faults, thrust belts, deformations, etc.) are located nearby the City and capable of producing significant earthquakes. The Background Report explains that both location from the City and seismic activity of the fault (Richter Scale “maximum credible earthquake magnitude”) are the two most important indicators of the potential threat from an active fault. The following table summarizes the various faults, distances from City Hall, and the maximum credible earthquake magnitude:

Fault	Distance from City Hall (Miles)	Maximum Credible EQ Magnitude (Richter Scale)
Elsinore Fault Zone	26	7.25
Elysian Park Fold and Thrust Belt	6	6.5
Newport-Inglewood Fault Zone	13	7.0
Palos Verdes Fault Zone	20	7.0
San Andreas Fault Zone	34	8.5
San Jacinto Fault Zone	43	7.5
Sierra Madre Fault System	20	7.0
Whittier Fault	1.2	7.0

Geologic evidence suggests that the San Andreas Fault has a 50 percent chance of producing a magnitude 7.5 to 8.5 quake (comparable to the great San Francisco earthquake of 1906) within the next 30 years. A significant earthquake originating along any of the identified faults could cause damage to buildings and infrastructure as well as injuries and fatalities throughout Whittier.

Additionally, it’s common for seismic disturbances to trigger secondary effects or hazards associated with subsurface movement, such as ground shaking and ground failure, which are discussed later in this section.

In addition to the loss of production capabilities, the economic impact on the City from a major earthquake would be considerable in terms of loss of employment and loss of tax base. Also, a major earthquake could cause serious damage and/or outage to computer facilities. The loss of

such facilities could curtail or seriously disrupt the operations of banks, insurance companies, and other elements of the financial community. In turn, this could affect the ability of local government, business and the population to make payments and purchases.

Measuring and Describing Earthquakes

An earthquake is a sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of the Earth's tectonic plates. The effects of an earthquake can be felt far beyond the site of its occurrence. They usually occur without warning and, after just a few seconds, can cause massive damage and extensive casualties. Common effects of earthquakes are ground motion and shaking, surface fault ruptures, and ground failure. Ground motion is the vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter. Soft soils can further amplify ground motions. The severity of these effects is dependent on the amount of energy released from the fault or epicenter. One way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. The acceleration due to gravity is often called "g". A ground motion with a peak ground acceleration of 100%g is very severe. Peak Ground Acceleration (PGA) is a measure of the strength of ground motion. PGA is used to project the risk of damage from future earthquakes by showing earthquake ground motions that have a specified probability (10%, 5%, or 2%) of being exceeded in 50 years. These ground motion values are used for reference in construction design for earthquake resistance. The ground motion values can also be used to assess relative hazard between sites, when making economic and safety decisions.

When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter.

Another tool used to describe earthquake intensity is the Magnitude Scale. The Magnitude Scale is sometimes referred to as the Richter Scale. The two are similar but not exactly the same. The Magnitude Scale was devised as a means of rating earthquake strength and is an indirect measure of seismic energy released. The Scale is logarithmic with each one-point increase corresponding to a 10-fold increase in the amplitude of the seismic shock waves generated by the earthquake. In terms of actual energy released, however, each one-point increase on the Richter scale corresponds to about a 32-fold increase in energy released. Therefore, a Magnitude 7 (M7) earthquake is 100 times (10 X 10) more powerful than a M5 earthquake and releases 1,024 times (32 X 32) the energy.

An earthquake generates different types of seismic shock waves that travel outward from the focus or point of rupture on a fault. Seismic waves that travel through the earth's crust are called body waves and are divided into primary (P) and secondary (S) waves. Because P waves move faster (1.7 times) than S waves, they arrive at the seismograph first. By measuring the time delay between arrival of the P and S waves and knowing the distance to the epicenter, seismologists can compute the magnitude for the earthquake.

The duration of an earthquake is related to its magnitude but not in a perfectly strict sense. There are two ways to think about the duration of an earthquake. The first is the length of time it

takes for the fault to rupture and the second is the length of time shaking is felt at any given point (e.g. when someone says "I felt it shake for 10 seconds" they are making a statement about the duration of shaking). (Source: www.usgs.gov)

The Modified Mercalli Scale (MMI) is another means for rating earthquakes, but one that attempts to quantify intensity of ground shaking. Intensity under this scale is a function of distance from the epicenter (the closer to the epicenter the greater the intensity), ground acceleration, duration of ground shaking, and degree of structural damage. This rates the level of severity of an earthquake by the amount of damage and perceived shaking (Table: Modified Mercalli Intensity Scale).

Table: Modified Mercalli Intensity Scale

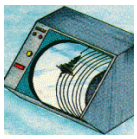
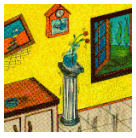
	MMI Value	Description of Shaking Severity	Summary Damage Description Used on 1995 Maps	Full Description
	I			Not Felt
	II			Felt by persons at rest, on upper floors, or favorably placed.
	III			Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
	IV			Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motorcars rock. Windows, dishes, doors rattle. In the upper range of IV, wooden walls and frame creak.
	V	Light	Pictures Move	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clock stop, start, change rate.

Table: Modified Mercalli Intensity Scale

	MMI Value	Description of Shaking Severity	Summary Damage Description Used on 1995 Maps	Full Description
	VI	Moderate	Objects Fall	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked.
	VII	Strong	Nonstructural Damage	Difficult to stand. Noticed by drivers of motorcars. Hanging objects quiver. Furniture broken. Damage to masonry, including cracks. Weak chimneys broken at roofline. Fall of plaster, loose bricks, stones, tiles, cornices. Some cracks in masonry C. Small slides and caving in along sand or gravel banks. Concrete irrigation ditches damaged.
	VIII	Very Strong	Moderate Damage	Steering of motorcars affected. Damage to masonry C, partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, and elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Cracks in wet ground and on steep slopes.
	IX	Violent	Heavy damage	General panic. Damage to masonry buildings ranges from collapse to serious damage unless modern design. Wood-frame structures rack, and, if not bolted, shifted off foundations. Underground pipes broken.
	X	Very Violent	Extreme Damage	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land.
	XI			Rails bent greatly. Underground pipelines completely out of services.

Table: Modified Mercalli Intensity Scale

	MMI Value	Description of Shaking Severity	Summary Damage Description Used on 1995 Maps	Full Description
	XII			Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air.

Impact of Earthquakes in the City of Whittier*

Based on the risk assessment, it is evident that earthquakes will continue to have potentially devastating economic impacts to certain areas of the city. Impacts that are not quantified, but can be anticipated in future events, include:

- ✓ Injury and loss of life;
- ✓ Commercial and residential structural damage;
- ✓ Disruption of and damage to public infrastructure;
- ✓ Secondary health hazards e.g. mold and mildew;
- ✓ Damage to roads/bridges resulting in loss of mobility;
- ✓ Significant economic impact (jobs, sales, tax revenue) upon the community;
- ✓ Negative impact on commercial and residential property values; and
- ✓ Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.

A major earthquake could disrupt, damage, or destroy computer facilities, which could curtail the operations of banks, insurance companies, and other elements of the financial community for several days or weeks.

Severity

A major earthquake occurring in or near Whittier could cause many deaths and injuries, extensive property damage, fires, hazardous material spills, and other dangers. Aftershocks and the secondary effects of fire, hazardous material/chemical accidents, and possible failure of dams and waterways could aggravate the situation.

The time of day and season of the year would have a profound impact on the number of dead and injured and the amount of property damage. Such an earthquake could exceed the response capabilities of the individual cities, Los Angeles County Operational Area, and the State of California Emergency Management Agency. Support of damage control and disaster relief could be required from other local governments and private organizations, as well as

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* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3**

B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))

the state and federal governments.

Extensive search and rescue operations could be required to assist trapped persons. Mass evacuation could be essential to save lives, particularly in areas downwind from hazardous material releases. Emergency medical care, food, and temporary shelter could be required by injured or displaced persons.

Many families could be separated, particularly if the earthquake occurs during working hours. A personal inquiry or locator system could be essential to maintain morale. Emergency operations could be seriously hampered by a loss of communications, damage to transportation routes, and/or disruption of public utilities and services.

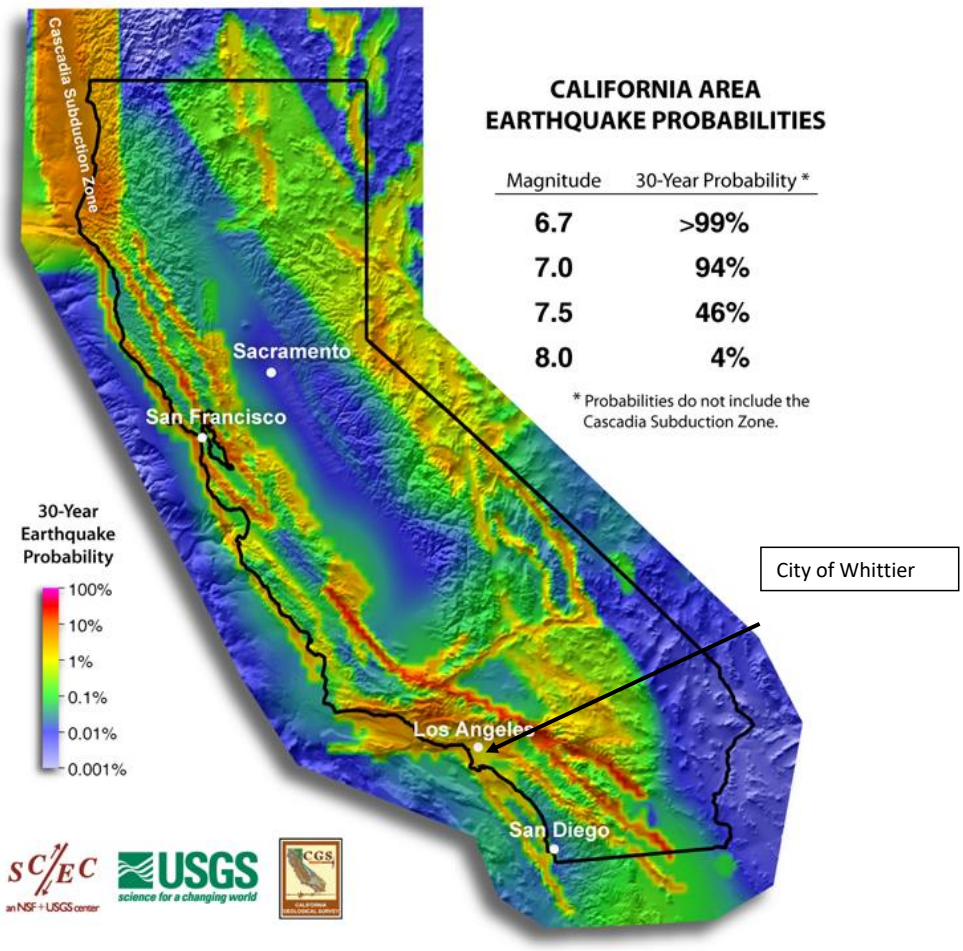
The economic impact on the City could be considerable in terms of lost employment and lost tax base. A major earthquake could disrupt, damage, or destroy computer facilities, which could curtail the operations of banks, insurance companies, and other elements of the financial community for several days or weeks. This could affect the ability of local government, business, and residents to make payments and purchases. (Source: California Division of Mines and Geology, Special Publication 60, *Earthquake Planning Scenario for a Magnitude 8.3 Earthquake on the San Andreas Fault in Southern California,* 1982.)

Earthquake Hazard Assessment

Hazard Identification

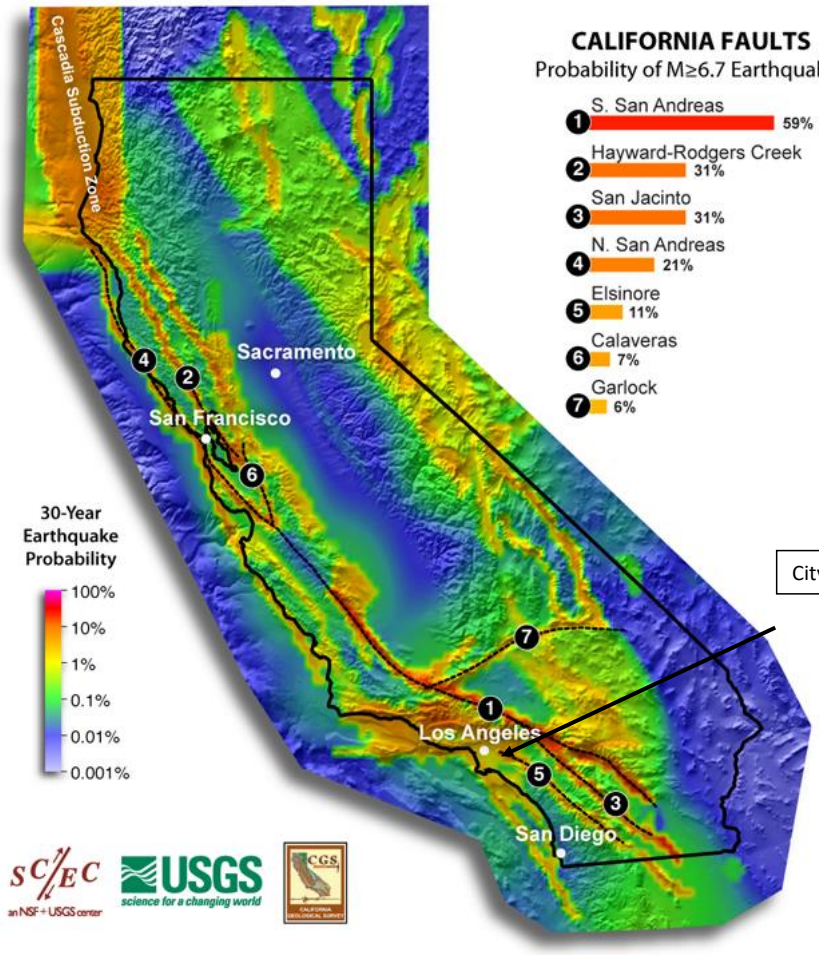
The 2007 Working Group on California Earthquake Probabilities (WGCEP 2007), a multi-disciplinary collaboration of scientists and engineers, has released the Uniform California Earthquake Rupture Forecast (UCERF), the first comprehensive framework for comparing earthquake possibilities throughout all of California. In developing the UCERF, the 2007 Working Group revised earlier forecasts for Southern California (WGCEP 1995) and the San Francisco Bay Area (WGCEP 2003) by incorporating new data on active faults and an improved scientific understanding of how faults rupture to produce large earthquakes. It extended the forecast across the entire state using a uniform methodology, allowing for the first time, meaningful comparisons of earthquake probabilities in urbanized areas such as Los Angeles and San Francisco Bay Area, as well as comparisons among the large faults in different parts of the State. The study was organized by the Southern California Earthquake Center, the U.S. Geological Survey, and the California Geological Survey, and it received major support from the California Earthquake Authority, which is responsible for setting earthquake insurance rates statewide. According to the new forecast, California has a 99.7% chance of having a magnitude 6.7 or larger earthquake during the next 30 years. The likelihood of an even more powerful quake of magnitude 7.5 or greater in the next 30 years is 46%.

Map: California Area Earthquake Probabilities
(Source www.sced.org/ucerf)



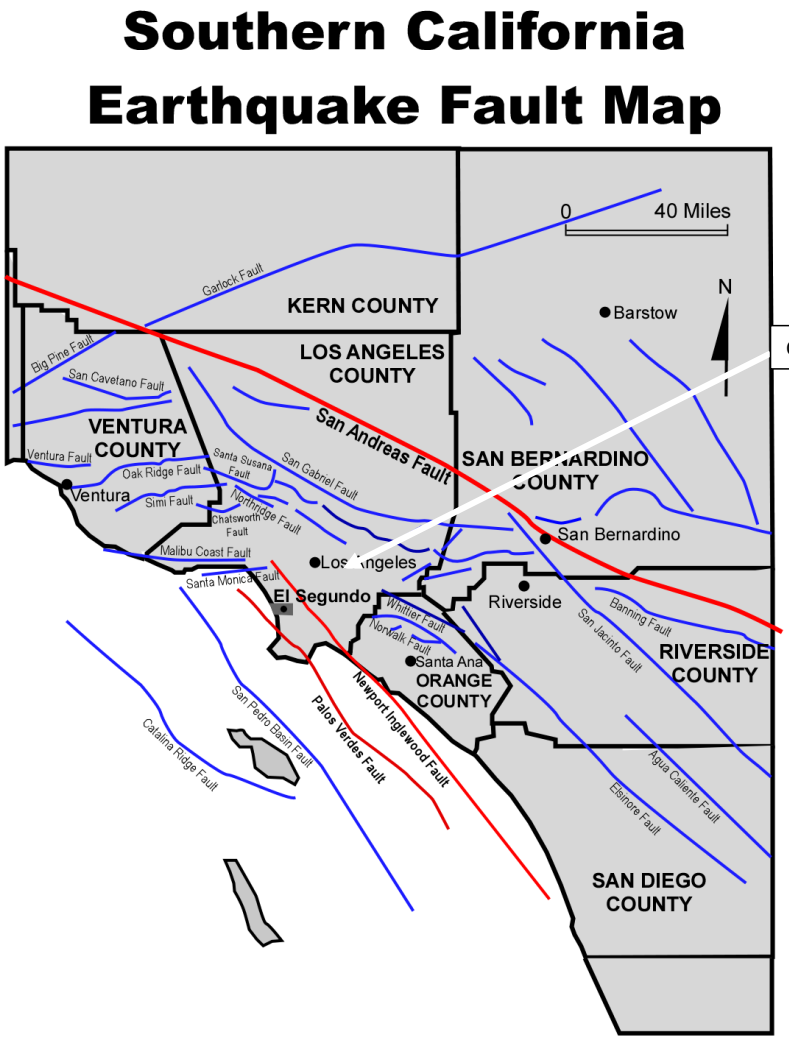
City of Whittier

Map: California Faults
(Source www.scec.org/ucerf)



City of Whittier

Map: Southern California Earthquake Fault Map



Earthquake Probable Events

Following is a list of regional faults and associated data. (Source: Southern California Earthquake Data Center)

Elsinore Fault Zone
TYPE OF FAULTING: right-lateral strike-slip
LENGTH: about 180 km (not including the Whittier, Chino, and Laguna Salada Faults)
NEARBY COMMUNITIES: Temecula, Lake Elsinore, Julian
LAST MAJOR RUPTURE: May 15, 1910; Magnitude 6 -- no surface rupture found
SLIP RATE: roughly 4.0 mm/yr
INTERVAL BETWEEN MAJOR RUPTURES: roughly 250 years
PROBABLE MAGNITUDES: M6.5 - 7.5
MOST RECENT SURFACE RUPTURE: 18th century A.D.(?)

Newport-Inglewood Fault Zone
TYPE OF FAULTING: right-lateral; local reverse slip associated with fault steps
LENGTH: 75 km
NEAREST COMMUNITIES: Culver City, Inglewood, Gardena, Compton, Signal Hill, Long Beach, Seal Beach, Huntington Beach, Newport Beach, Costa Mesa
MOST RECENT MAJOR RUPTURE: March 10, 1933, MW6.4 (but no surface rupture)
SLIP RATE: 0.6 mm/yr
INTERVAL BETWEEN MAJOR RUPTURES: unknown
PROBABLE MAGNITUDES: M6.0 - 7.4
OTHER NOTES: Surface trace is discontinuous in the Los Angeles Basin, but the fault zone can easily be noted there by the existence of a chain of low hills extending from Culver City to Signal Hill. South of Signal Hill, it roughly parallels the coastline until just south of Newport Bay, where it heads offshore, and becomes the Newport-Inglewood - Rose Canyon Fault Zone.

Palos Verdes Fault Zone
TYPE OF FAULT: right-reverse (?)
LENGTH: roughly 80 km
NEARBY COMMUNITIES: San Pedro, Palos Verdes Estates, Torrance, Redondo Beach
MOST RECENT SURFACE RUPTURE: Holocene, offshore; Late Quaternary, onshore
SLIP RATE: between 0.1 and 3.0 mm/yr
INTERVAL BETWEEN MAJOR RUPTURES: unknown
PROBABLE MAGNITUDES: M6.0 - 7.0 (or greater?); fault geometries may allow only partial rupture at any one time
OTHER NOTES: Has two main branches (see below). Continues southward as the Palos Verdes - Coronado Bank Fault Zone.

San Andreas Fault Zone
TYPE OF FAULT: right-lateral strike-slip
LENGTH: 1200 km 550 km south from Parkfield; 650km northward
NEARBY COMMUNITY: Parkfield, Frazier Park, Palmdale, Wrightwood, San Bernardino, Banning, Indio
LAST MAJOR RUPTURE: January 9, 1857 (Mojave segment); April 18, 1906 (Northern segment)
SLIP RATE: about 20 to 35 mm per year
INTERVAL BETWEEN MAJOR RUPTURES: average of about 140 years on the Mojave

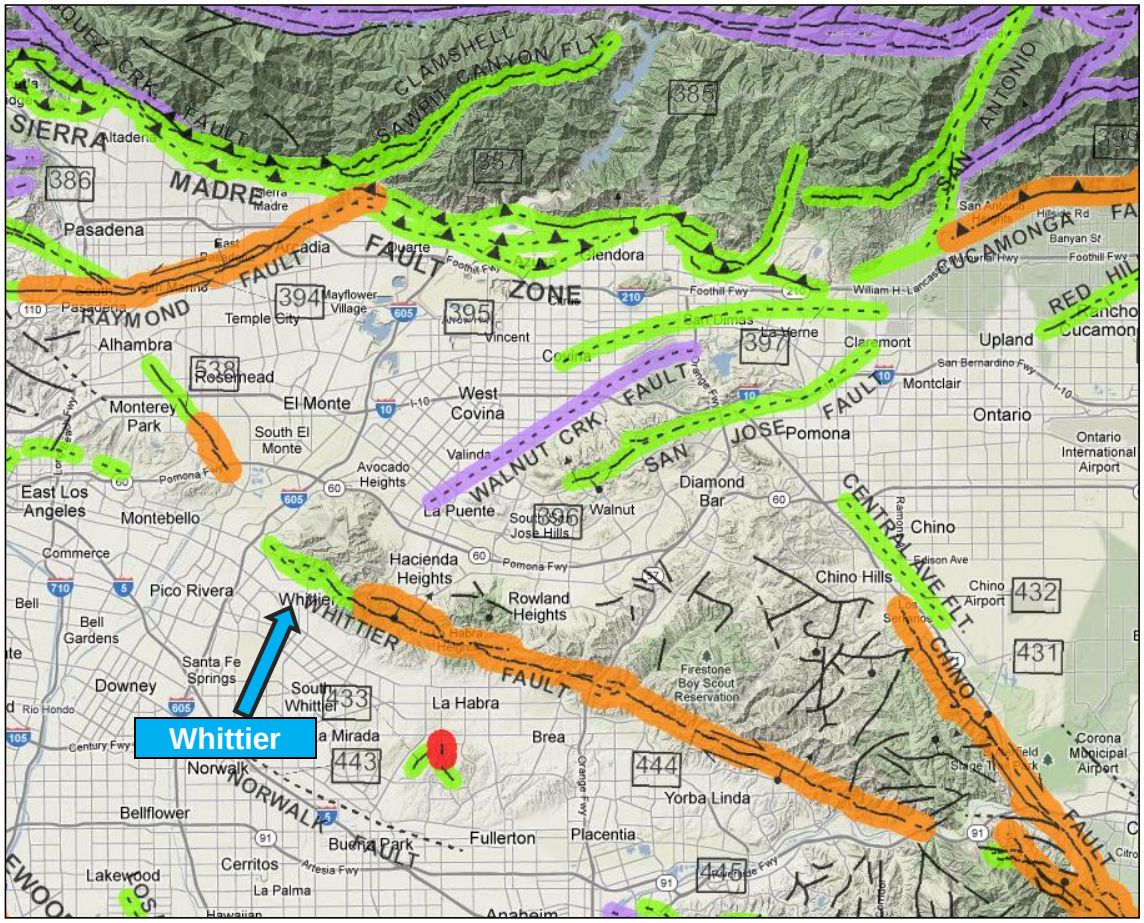
segment; recurrence interval varies greatly -- from under 20 years (at Parkfield only) to over 300 years
PROBABLE MAGNITUDES: M6.8 - 8.0

San Jacinto Fault Zone
TYPE OF FAULTING : right-lateral strike-slip; minor right-reverse
LENGTH: 210 km, including Coyote Creek Fault
NEARBY COMMUNITIES: Lytle Creek, San Bernardino, Loma Linda, San Jacinto, Hemet, Anza, Borrego Springs, Ocotillo Wells
MOST RECENT SURFACE RUPTURE: within the last few centuries; April 9, 1968, M6.5 on Coyote Creek segment
SLIP RATE: typically between 7 and 17 mm/yr
INTERVAL BETWEEN SURFACE RUPTURES: between 100 and 300 years, per segment
PROBABLE MAGNITUDES: M6.5 - 7.5

Sierra Madre Fault System
TYPE OF FAULTING: reverse
LENGTH: the zone is about 55 km long;
total length of main fault segments is about 75 km, with each segment measuring roughly 15 km long
NEARBY COMMUNITIES: Sunland, Altadena, Sierra Madre, Monrovia, Duarte, Glendora
MOST RECENT SURFACE RUPTURE: Holocene
SLIP RATE: between 0.36 and 4 mm/yr
INTERVAL BETWEEN SURFACE RUPTURES: several thousand years (?)
PROBABLE MAGNITUDES: M6.0 - 7.0 (?)
OTHER NOTES: This fault zone dips to the north. It was not the fault responsible for the 1991 Sierra Madre earthquake.

Whittier Fault
TYPE OF FAULTING: right-lateral strike-slip with some reverse slip
LENGTH: about 40 km
NEARBY COMMUNITIES: Yorba Linda, Hacienda Heights, Whittier
MOST RECENT SURFACE RUPTURE: Holocene
SLIP RATE: between 2.5 and 3.0 mm/yr
INTERVAL BETWEEN MAJOR RUPTURES: unknown
PROBABLE MAGNITUDES: M6.0 - 7.2
OTHER NOTES: The Whittier Fault dips toward the northeast.

Map: Regional Fault Map
(Source: State of California Department of Conservation)



Vulnerability Assessment

The effects of earthquakes span a large area, and large earthquakes occurring in many parts of the Southern California region would probably be felt throughout the region. However, the degree to which the earthquakes are felt, and the damages associated with them may vary. At risk from earthquake damage are large stocks of old buildings and bridges: many high tech and hazardous materials facilities: extensive sewer, water, and natural gas pipelines; earth dams; petroleum pipelines; and other critical facilities and private property located in the county. The relative or secondary earthquake hazards, which are liquefaction, ground shaking, amplification, and earthquake-induced landslides, are just as devastating as the earthquake.

Earthquake Related Hazards

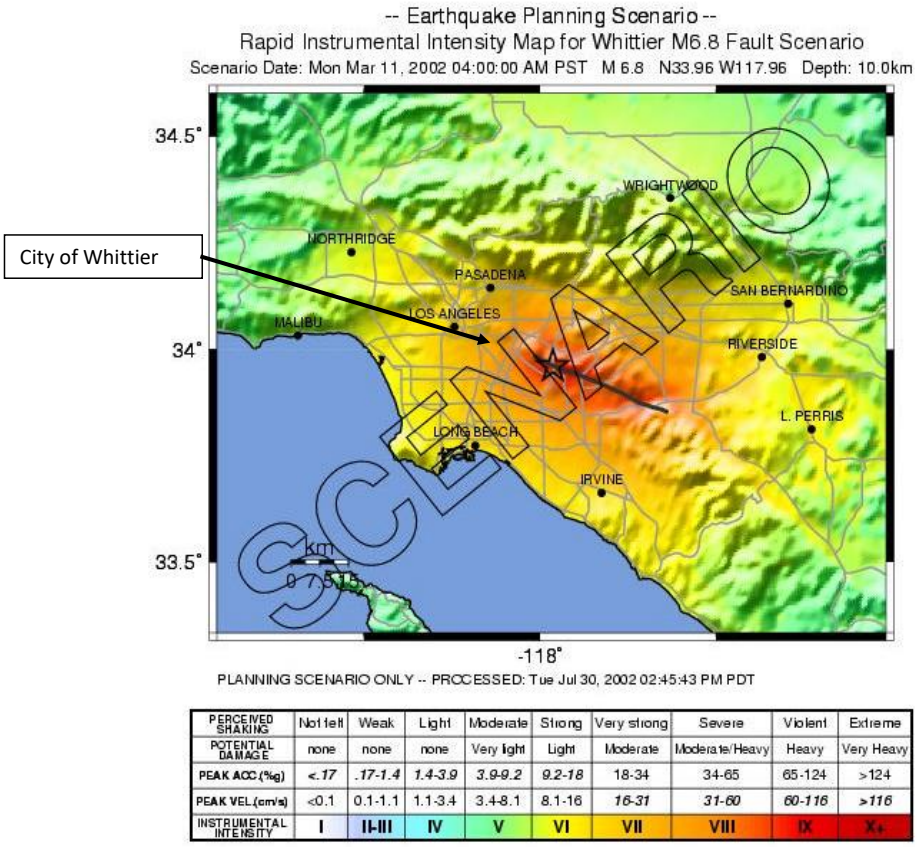
Ground shaking, landslides, liquefaction, and amplification are the specific hazards associated with earthquakes. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to the fault, earthquake magnitude, and the type of earthquake.

Ground Shaking

Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by the earthquake. It is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, and distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

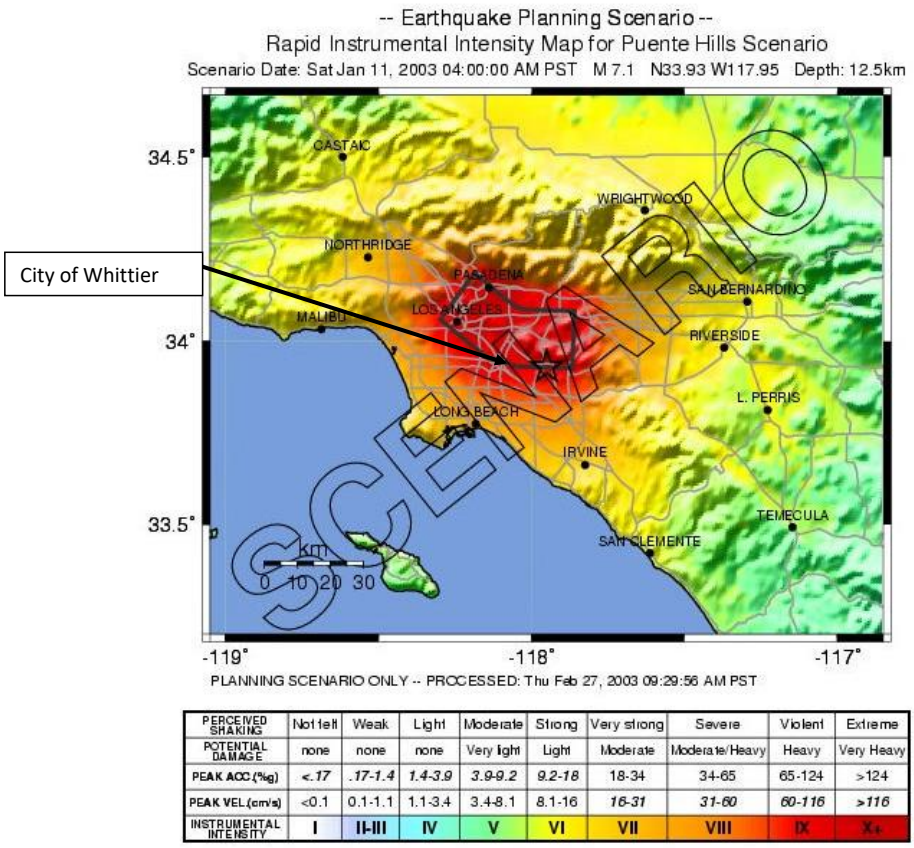
Seismic activity along nearby or more distant fault zones are likely to cause ground shaking within the City limits.

Map 7-5: Seismic Shaking Intensities for the Whittier Fault
(Source: ftp://ftp.consrv.ca.gov/pub/dmg/rgmp/loss/s11.pdf)



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Map 7-6: Seismic Shaking Intensities for the Puente Hills Fault
(Source: ftp://ftp.consrv.ca.gov/pub/dmg/rgmp/loss/s15.pdf)



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Fault Rupture

The potential for ground rupture due to fault movement is related to the seismic activity of known fault zones. Recognized active fault zones are located inside and outside the City of Whittier. It's important to note that even faults 20+ away could conceivably cause ground rupture within the City. *Note: Refer to the Whittier Background Report to the General Plan for additional information.*

Earthquake-Induced Landslide Potential

Generally, these types of failures consist of rock falls, disrupted soil slides, rock slides, soil lateral spreads, soil slumps, soil block slides, and soil avalanches. Areas having the potential for

earthquake-induced landslides generally occur in areas of previous landslide movement, or where local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements. *Note: Refer to the Whittier Background Report to the General Plan for maps and additional information.*

Earthquake-Induced Landslides

Earthquake-induced landslides are secondary earthquake hazards that occur from ground shaking. They can destroy the roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake. Many communities in Southern California have a high likelihood of encountering such risks, especially in areas with steep slopes.

The Whittier Background Report to the General Plan indicates that seismic-induced slope failure can be expected within the hillsides north of the City of Whittier where slopes are 35 degrees or greater. The Report also states that slope failures are also highly probable where coarse rocks cover the bedrock hillsides.

Liquefaction

Soil liquefaction is a seismically induced form of ground failure, which has been a major cause of earthquake damage in southern California.

Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other events. Liquefaction occurs in saturated soils, which are soils in which the space between individual soil particles is completely filled with water. This water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together. Prior to an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to increase to the point where the soil particles can readily move with respect to each other. Because liquefaction only occurs in saturated soil, its effects are most commonly observed in low lying areas. Typically liquefaction is associated with shallow groundwater, which is less than 50 feet beneath the earth's surface.

According to the Whittier Background Report to the General Plan, the City is located in an area that ranges in liquefaction susceptibility from very low to moderate, depending on the location and depth to ground water. The majority of the City exhibits very low to low liquefaction susceptibility. Areas located in or at the mouths of canyons, and/or areas where there is shall ground water, are considered to have a moderate liquefaction susceptibility. Liquefaction within the City is generally not a hazard as the water table is deeper than 50 feet except for areas along drainage channels and shallow groundwater.

Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these structures. Liquefaction generally occurs during significant earthquake activity, and structures located on soils such as silt or sand may experience significant damage during an earthquake due to the instability of structural foundations and the moving earth. Many communities in southern California are built on ancient river bottoms and have sandy soil. In some cases this ground may be subject to liquefaction, depending on the depth of the water table.

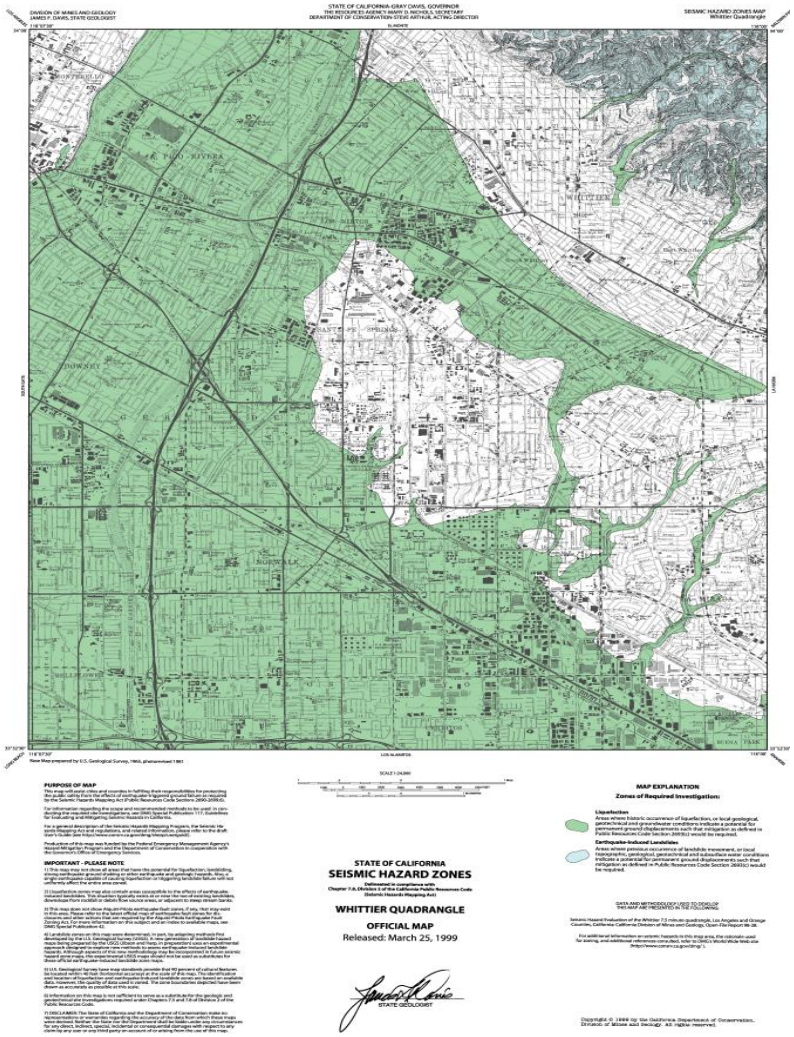
Soil liquefaction is a seismically-induced form of ground failure, which has been a major cause of earthquake damage in southern California. During the 1971 San Fernando and 1994 Northridge earthquakes, significant damage to roads, utility pipelines, buildings, and other structures in the Los Angeles area were caused by liquefaction. Research and historical data indicate that loose, granular materials situated at depths of less than 50 feet with fines (silt and clay) contents of less than 30 percent, which are saturated by a relatively shallow groundwater table are most susceptible to liquefaction. These geological and groundwater conditions exist in parts of southern California and Whittier, typically in valley regions and alleviated floodplains.

For liquefaction to occur, three general conditions must be met. The first condition – strong ground shaking of relatively long duration – can be expected to occur in the Whittier area as a result of an earthquake on any of the several active faults in the region. The second condition – loose, or unconsolidated, recently deposited sediments consisting primarily of silt and sand – occurs in a large portion of the valley floors, and in the larger canyon bottoms prevalent throughout Los Angeles County. The third condition is water saturated sediments within about 50 feet of the surface.

The California Geological Survey has identified areas most vulnerable to liquefaction. Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures. Map: Liquefaction and EQ-Induced Landslide Potential – Whittier Quadrangle identifies areas in the vicinity that are subject to liquefaction and landslides associated with earthquake activities.

The City of Whittier has facilities near liquefaction zones as shown on Map: Liquefaction and EQ-Induced Landslide Potential – Whittier Quadrangle.

Map: Liquefaction and EQ-Induced Landslide Potential – Whittier Quadrangle
(Source: http://gmw.consrv.ca.gov/shmp/download/pdf/ozn_whitt.pdf) (Note: a larger version of this map is available in City Hall)



STATE OF CALIFORNIA
SEISMIC HAZARD ZONES
WHITTIER QUADRANGLE
OFFICIAL MAP
Released: March 25, 1999

STATE GEOLOGIST

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Structure Failure

Whittier has a mix of older and newer structures. Since Whittier is still occupied with numerous structures constructed prior to modern building codes (beginning in 1973), many structures could be vulnerable to considerable damage following a significant seismic event.

> *"As the majority of homes in Whittier are over 50 years old, housing age and its condition will remain an ongoing priority in Whittier."*
> ***General Plan Housing Element***

As identified in the Whittier General Plan Housing Element (2014), Whittier has a predominantly older housing stock, with only 11% built since the 1970s. Most of the housing (63%) was built in the 1950s or earlier.

Table: Whittier Housing Age
(Source: Whittier General Plan – Housing Element 2014)

Decade Built	Housing Age	
	Number of Units	Percent of Units
Built 2000 or later	320	1%
1990s	664	2%
1980s	2,176	8%
1970s	3,268	11%
1960s	4,239	15%
1950s	10,914	38%
Before 1950	7,089	25%
Total	28,670	100%

Source: American Community Survey, 2006–20010.
Note: Sample counts do not take into account vacant units or all units.

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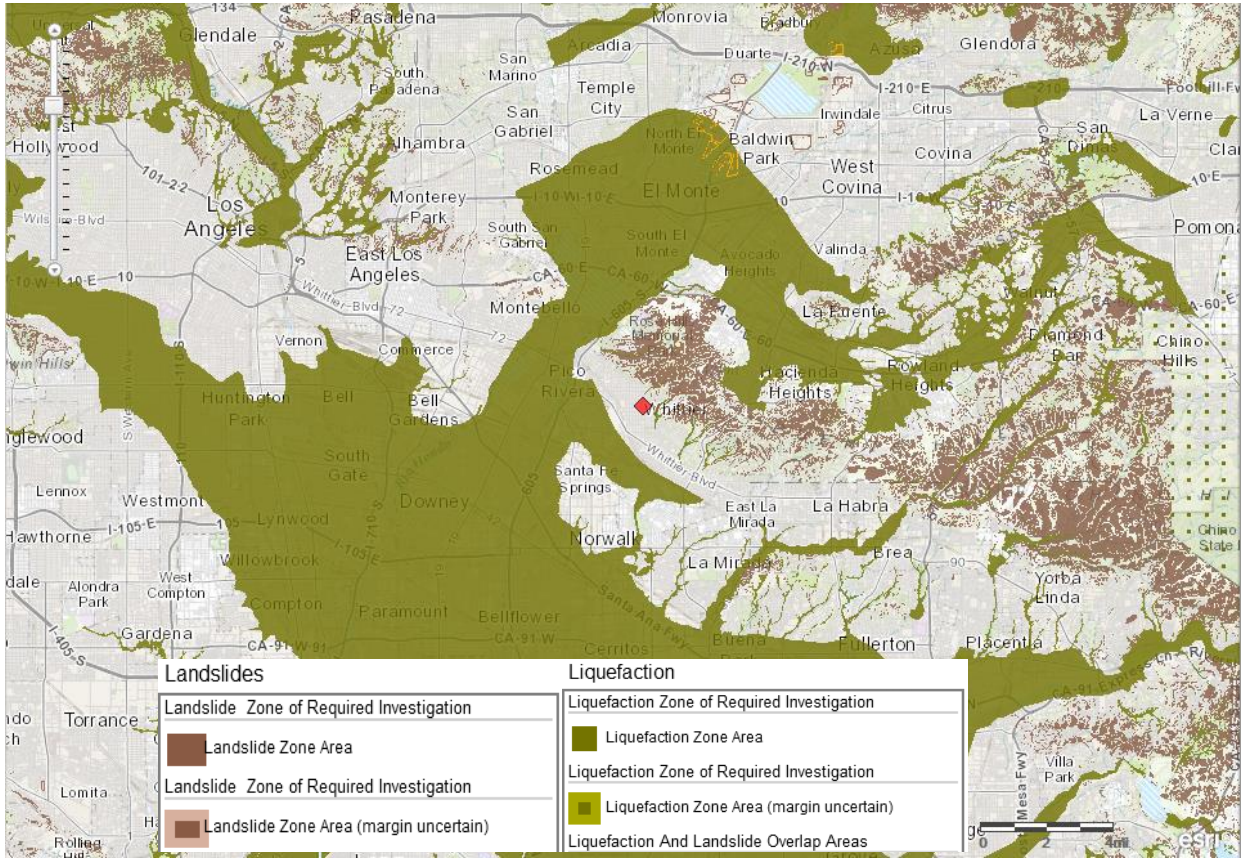
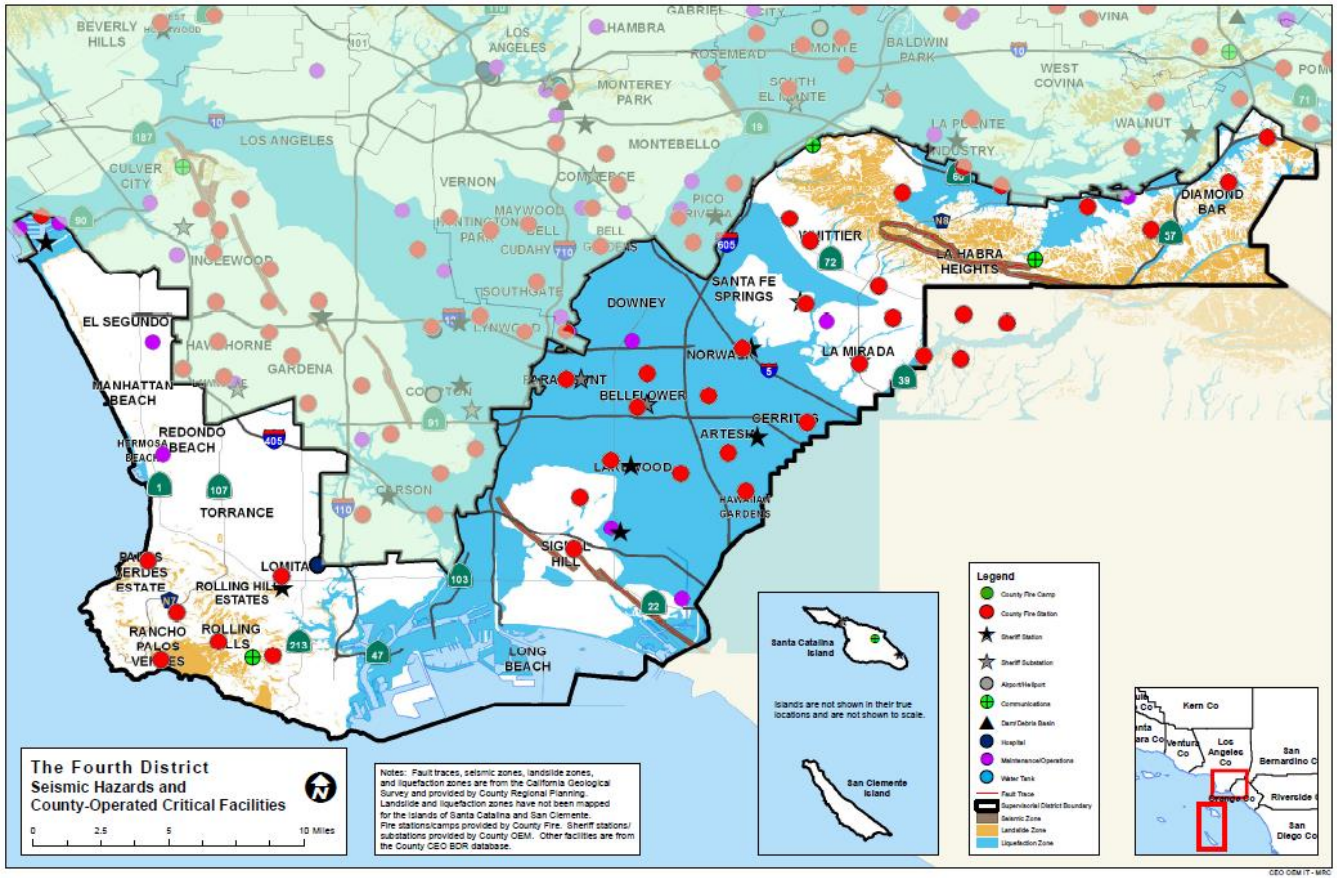
Amplification

Soils and soft sedimentary rocks near the earth's surface can modify ground shaking caused by earthquakes. One of these modifications is amplification. Amplification increases the magnitude of the seismic waves generated by the earthquake. The amount of amplification is influenced by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk. Amplification can also occur in areas with deep sediment filled basins and on ridge top.

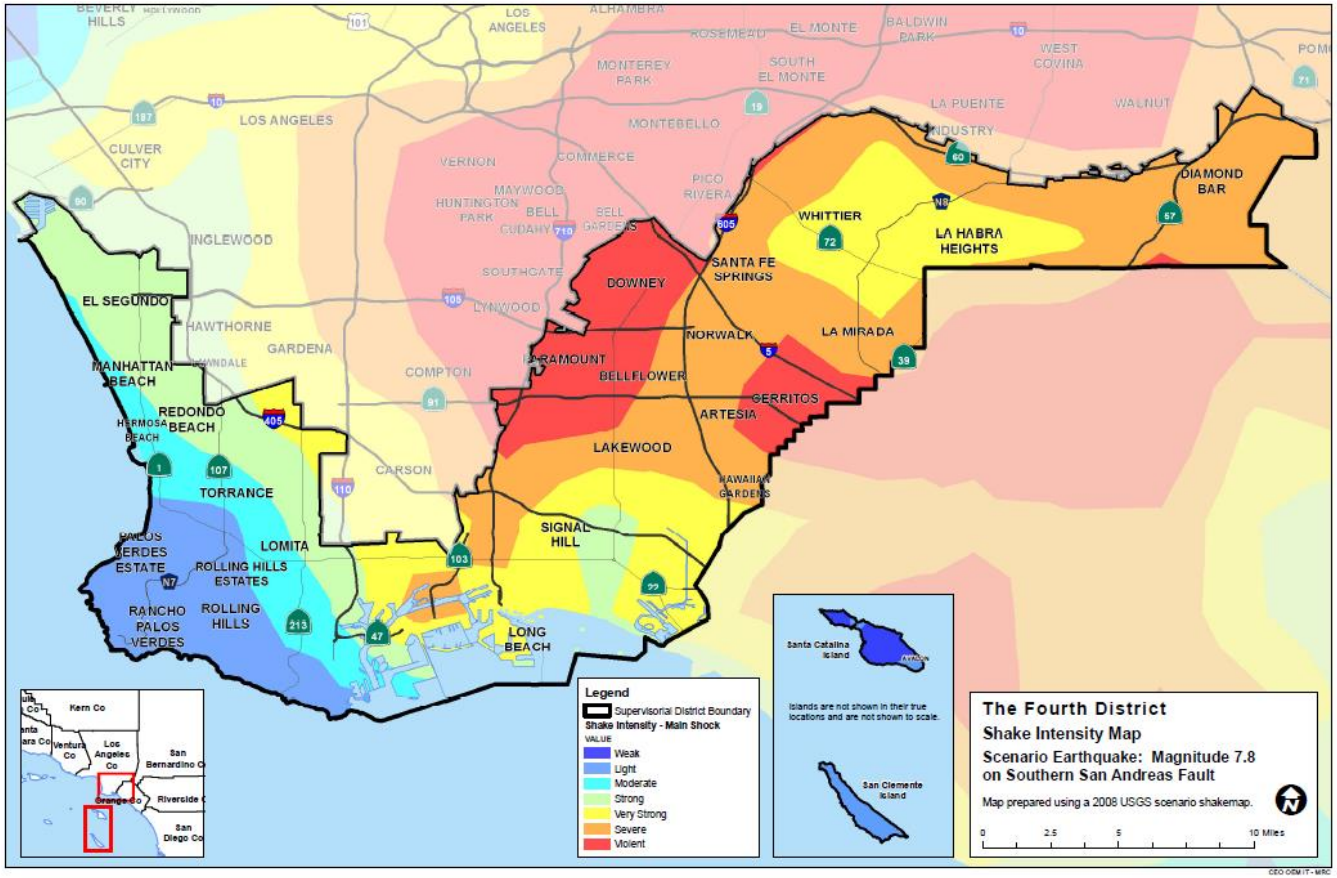
Map: Landslide and Liquefaction Zones in Whittier
(Source: California Office of Emergency Services)



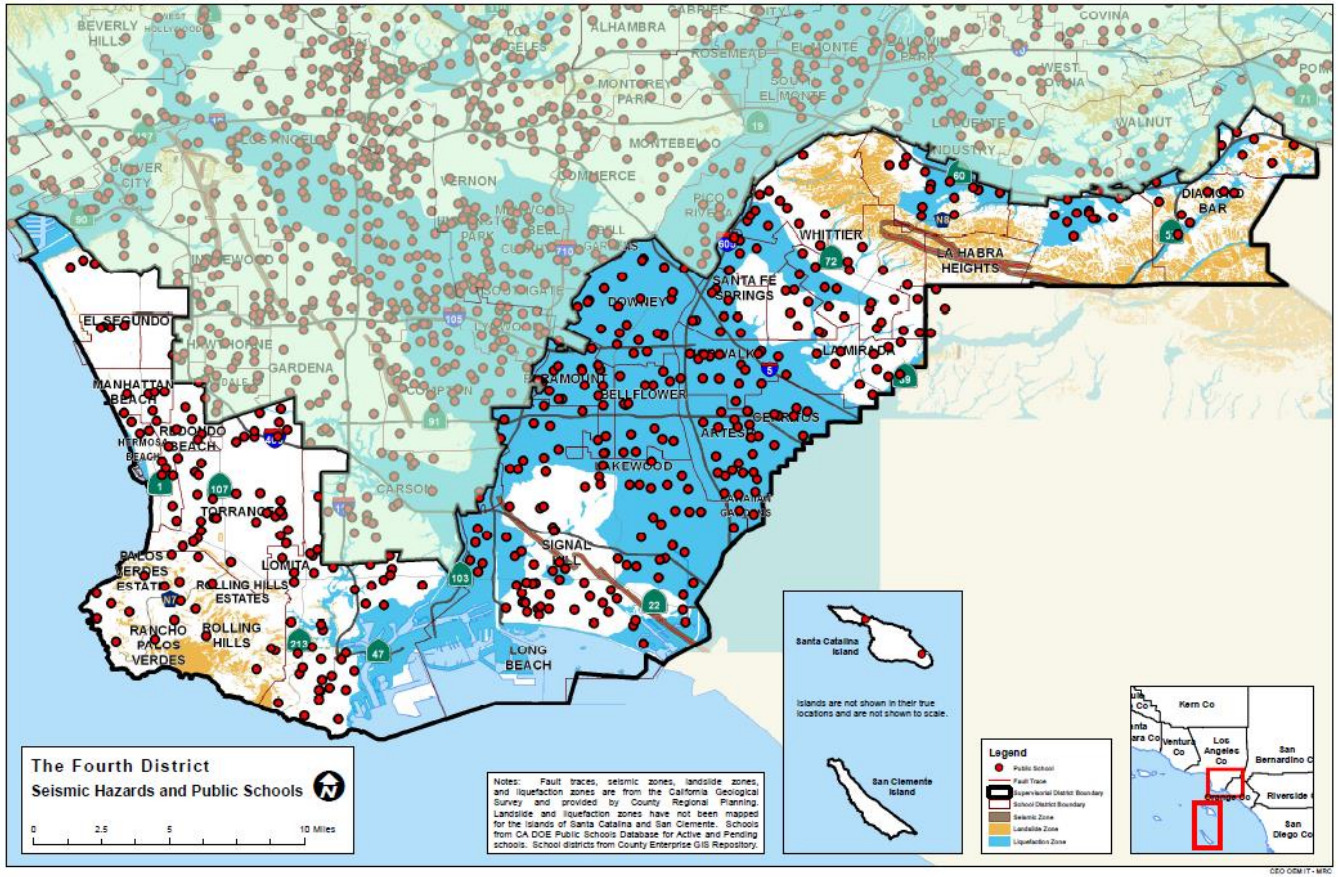
Map: Seismic Hazards and County-Operated Critical Facilities, District 4
(Source: County of Los Angeles Chief Executive Office - GIS)



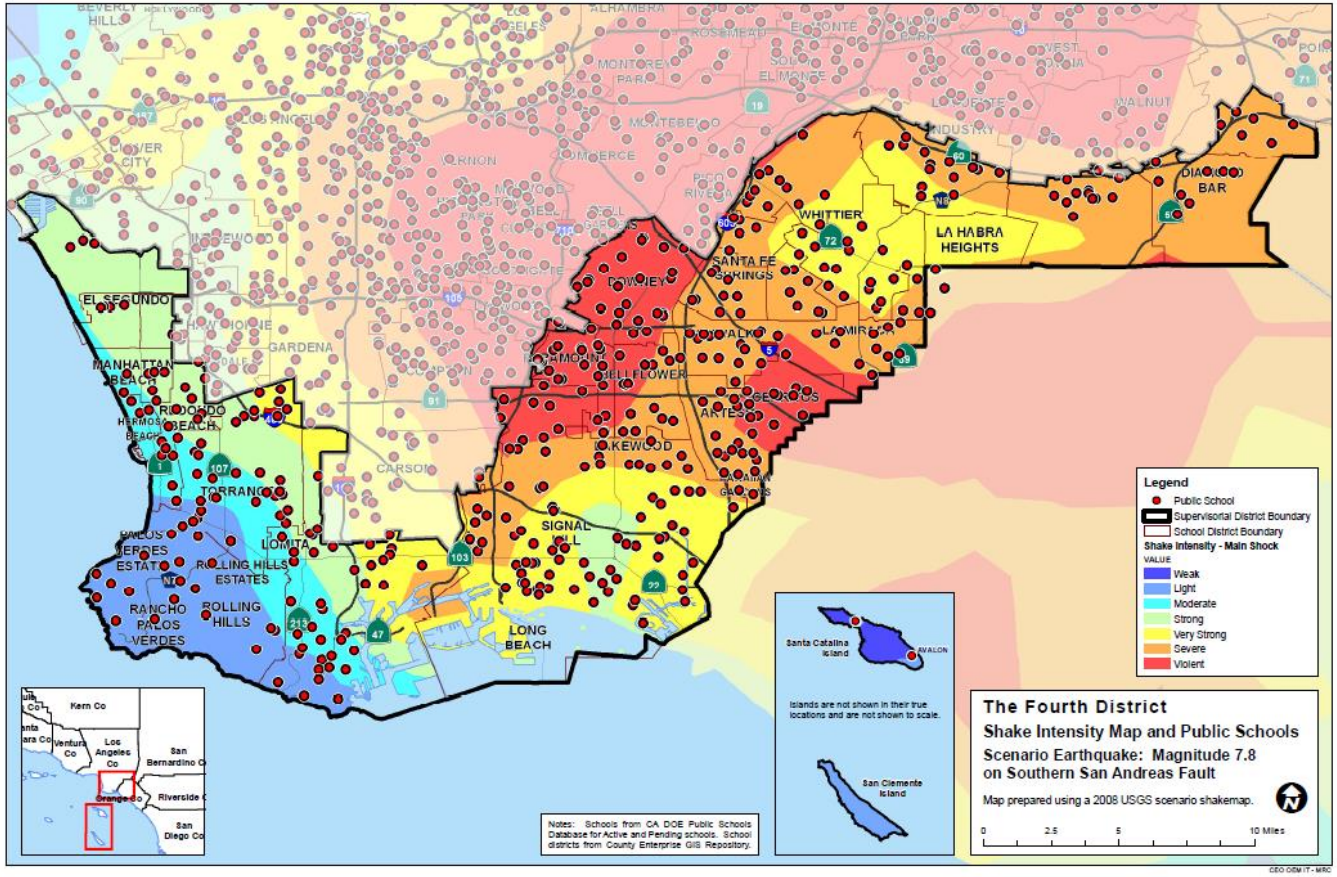
Map: Shake Intensity Map – San Andreas Fault M7.8, District 4
(Source: County of Los Angeles Chief Executive Office - GIS)



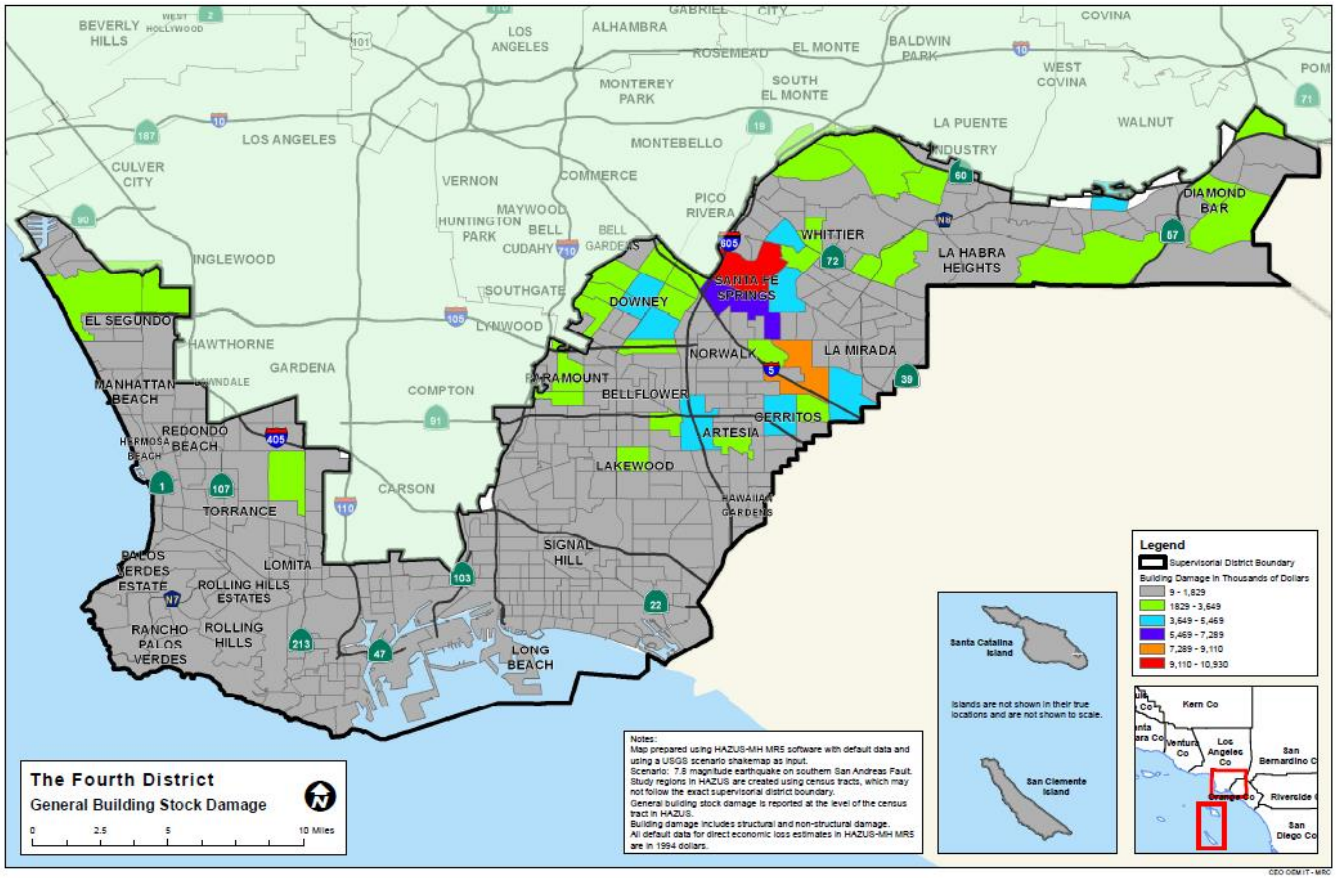
Map: Seismic Hazards and Public Schools, District 4
(Source: County of Los Angeles Chief Executive Office - GIS)



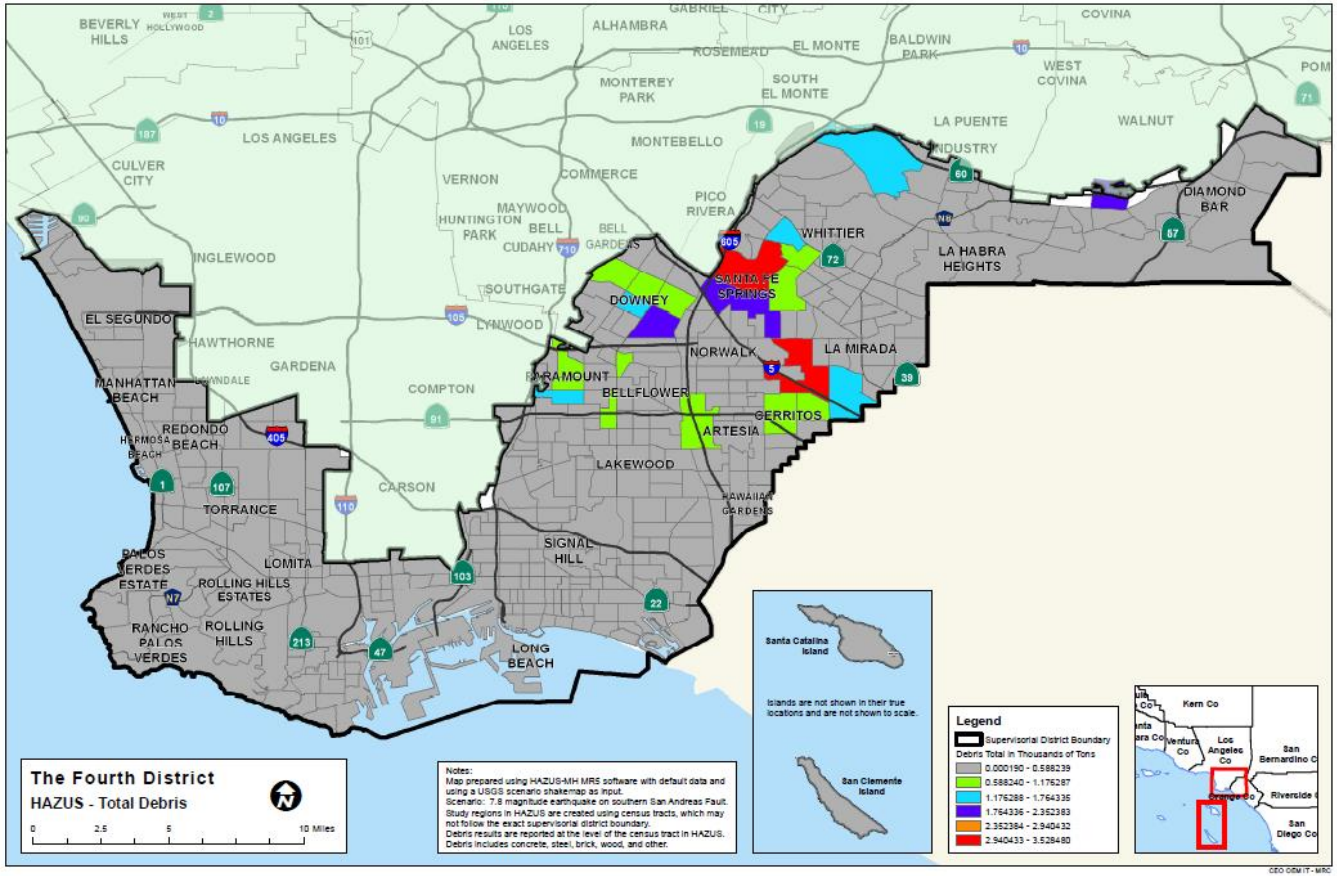
Map: Shake Intensity Map and Public Schools – San Andreas Fault M7.8, District 4
(Source: County of Los Angeles Chief Executive Office - GIS)



Map: General Building Stock Damage – San Andreas Fault M7.8, District 4
(Source: County of Los Angeles Chief Executive Office - GIS)



Map: Total Debris – San Andreas Fault M7.8, District 4
(Source: County of Los Angeles Chief Executive Office - GIS)



Attachment: HAZUS-MH Earthquake Event Report (All Districts) – San Andreas M7.8
(Source: County of Los Angeles Chief Executive Office - GIS)

HAZUS-MH: Earthquake Event Report

Region Name: LA County (All Districts)

Earthquake Scenario: ShakeMap_SAF_south78_se

Print Date: April 01, 2011

Totals only reflect data for those census tracts/blocks included in the user's study region.

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 4,086.90 square miles and contains 2,054 census tracts. There are over 3,133 thousand households in the region with a total population of 9,519,338 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2,400 thousand buildings in the region with a total building replacement value (excluding contents) of 690,925 (millions of dollars). Approximately 91.00 % of the buildings (and 0.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 50,964 and 7,421 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 2,400 thousand buildings in the region which have an aggregate total replacement value of 690,925 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 87% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 120 hospitals in the region with a total bed capacity of 28,258 beds. There are 3,230 schools, 50 fire stations, 166 police stations and 12 emergency operation facilities. With respect to HPL facilities, there are 103 dams identified within the region. Of these, 73 of the dams are classified as 'high hazard'. The inventory also includes 1,735 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 58,385.00 (millions of dollars). This inventory includes over 4,806 kilometers of highways, 3,128 bridges, 86,253 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	3,128	10,915.00
	Segments	4,366	36,692.90
	Tunnels	17	34.30
	Subtotal		**47,642.10**
Railways	Bridges	144	28.40
	Facilities	47	125.20
	Segments	594	885.40
	Tunnels	0	0.00
	Subtotal		**1,038.90**
Light Rail	Bridges	28	6.20
	Facilities	92	245.00
	Segments	99	376.50
	Tunnels	0	0.00
	Subtotal		**627.70**
Bus	Facilities	42	54.00
	Subtotal		**54.00**
Ferry	Facilities	10	13.30
	Subtotal		**13.30**
Port	Facilities	159	317.50
	Subtotal		**317.50**
Airport	Facilities	16	170.40
	Runways	29	1,101.00
	Subtotal		**1,271.40**
	Total		**50,965.00**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	862.50
	Facilities	15	589.40
	Pipelines	0	0.00
	Subtotal		**1,451.90**
Waste Water	Distribution Lines	NA	517.50
	Facilities	19	1,493.20
	Pipelines	0	0.00
	Subtotal		**2,010.70**
Natural Gas	Distribution Lines	NA	345.00
	Facilities	1	1.30
	Pipelines	0	0.00
	Subtotal		**346.30**
Oil Systems	Facilities	44	5.20
	Pipelines	0	0.00
	Subtotal		**5.20**
Electrical Power	Facilities	41	5,321.80
	Subtotal		**5,321.80**
Communication	Facilities	94	11.10
	Subtotal		**11.10**
	Total		**9,147.00**

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Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	ShakeMap_SAF_south78_se
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.80
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

HAZUS estimates that about 38,880 buildings will be at least moderately damaged. This is over 2.00 % of the total number of buildings in the region. There are an estimated 4,418 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	3,546	0.16	361	0.24	167	0.61	75	1.04	40	0.91
Commercial	135,569	6.13	11,912	7.92	4,449	16.34	1,384	19.15	818	18.51
Education	4,932	0.22	313	0.21	94	0.34	23	0.32	16	0.35
Government	2,159	0.10	194	0.13	98	0.36	32	0.44	12	0.27
Industrial	32,428	1.47	3,770	2.51	1,864	6.84	652	9.02	286	6.48
Other Residential	304,224	13.76	25,573	17.00	9,880	36.28	4,645	64.25	3,144	71.14
Religion	9,734	0.44	761	0.51	316	1.16	110	1.53	58	1.30
Single Family	1,718,758	77.72	107,545	71.49	10,364	38.06	308	4.26	46	1.03
Total	**2,211,351**		**150,428**		**27,232**		**7,229**		**4,419**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1,959,076	88.59	120896	80.37	11,572	42.49	372	5.14	149	3.36
Steel	45,376	2.05	5463	3.63	3,296	12.10	1,259	17.42	516	11.68
Concrete	49,136	2.22	4392	2.92	1,612	5.92	492	6.80	341	7.72
Precast	37,603	1.70	3603	2.39	1,216	4.47	296	4.09	184	4.17
RM	77,355	3.50	2877	1.91	1,107	4.07	444	6.15	261	5.90
URM	15,516	0.70	1861	1.24	394	1.45	91	1.26	130	2.94
MH	27,288	1.23	11335	7.54	8,034	29.50	4,275	59.14	2,838	64.23
Total	**2,211,351**		**150,428**		**27,232**		**7,229**		**4,419**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 28,258 hospital beds available for use. On the day of the earthquake, the model estimates that only 27,911 hospital beds (99.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	120	0	0	120
Schools	3,230	0	0	3,163
EOCs	12	0	0	11
PoliceStations	166	0	0	164
FireStations	50	0	0	48

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	4,366	0	0	4,366	4,366
	Bridges	3,128	48	3	3,078	3,100
	Tunnels	17	0	0	17	17
Railways	Segments	594	0	0	594	594
	Bridges	144	3	0	141	143
	Tunnels	0	0	0	0	0
	Facilities	47	0	0	47	47
Light Rail	Segments	99	0	0	99	99
	Bridges	28	0	0	28	28
	Tunnels	0	0	0	0	0
	Facilities	92	0	0	92	92
Bus	Facilities	42	1	0	42	42
Ferry	Facilities	10	0	0	10	10
Port	Facilities	159	0	0	159	159
Airport	Facilities	16	0	0	16	16
	Runways	29	0	0	29	29

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	15	0	0	15	15
Waste Water	19	0	0	17	19
Natural Gas	1	0	0	1	1
Oil Systems	44	0	0	44	44
Electrical Power	41	0	0	41	41
Communication	94	1	0	94	94

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	43,127	8647	2162
Waste Water	25,876	4344	1086
Natural Gas	17,251	1488	372
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	3,133,774	640,614	616,149	567,247	296,313	0
Electric Power		28,768	16,895	6,399	1,131	42

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 132 ignitions that will burn about 0.95 sq. mi 0.02 % of the region's total area.) The model also estimates that the fires will displace about 13,672 people and burn about 809 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1.550 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 32.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 62,160 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1,504 households to be displaced due to the earthquake. Of these, 1,387 people (out of a total population of 9,519,338) will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	19	5	1	1
	Commuting	0	0	1	0
	Educational	0	0	0	0
	Hotels	9	2	0	1
	Industrial	37	9	1	2
	Other-Residential	831	181	18	33
	Single Family	291	20	2	4
	Total	**1,188**	**217**	**23**	**42**
2 PM	Commercial	1,399	350	54	105
	Commuting	2	3	5	1
	Educational	724	202	33	65
	Hotels	2	0	0	0
	Industrial	270	62	9	17
	Other-Residential	183	41	4	8
	Single Family	57	4	0	1
	Total	**2,637**	**663**	**106**	**197**
5 PM	Commercial	1,313	339	54	100
	Commuting	67	91	152	30
	Educational	70	18	3	6
	Hotels	3	1	0	0
	Industrial	169	39	5	10
	Other-Residential	303	66	7	12
	Single Family	107	8	1	1
	Total	**2,032**	**562**	**222**	**160**

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Economic Loss

The total economic loss estimated for the earthquake is 7,732.12 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 7,183.68 (millions of dollars); 15 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 46 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	7.76	257.23	18.80	12.01	295.80
	Capital-Related	0.00	3.32	224.01	11.72	2.81	241.86
	Rental	16.21	39.21	117.18	7.95	5.82	186.37
	Relocation	49.94	53.60	161.02	34.04	39.77	338.37
	Subtotal	**66.15**	**103.90**	**759.44**	**72.51**	**60.41**	**1,062.39**
Capital Stock Losses							
	Structural	159.79	110.19	243.45	99.12	46.70	659.25
	Non_Structural	1,263.96	785.92	1,066.05	375.43	181.99	3,673.35
	Content	559.97	232.88	584.37	245.32	99.82	1,722.36
	Inventory	0.00	0.00	17.47	47.79	1.06	66.32
	Subtotal	**1,983.72**	**1,129.00**	**1,911.34**	**767.66**	**329.56**	**6,121.28**
	Total	**2,049.86**	**1,232.89**	**2,670.78**	**840.17**	**389.97**	**7,183.68**

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Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	36,692.89	$0.00	0.00
	Bridges	10,914.99	$108.43	0.99
	Tunnels	34.27	$0.25	0.72
	Subtotal	**47642.10**	**108.70**	
Railways	Segments	885.42	$0.00	0.00
	Bridges	28.36	$0.31	1.09
	Tunnels	0.00	$0.00	0.00
	Facilities	125.16	$12.09	9.66
	Subtotal	**1038.90**	**12.40**	
Light Rail	Segments	376.51	$0.00	0.00
	Bridges	6.17	$0.01	0.19
	Tunnels	0.00	$0.00	0.00
	Facilities	245.00	$25.85	10.55
	Subtotal	**627.70**	**25.90**	
Bus	Facilities	54.02	$6.03	11.17
	Subtotal	**54.00**	**6.00**	
Ferry	Facilities	13.31	$0.57	4.30
	Subtotal	**13.30**	**0.60**	
Port	Facilities	317.52	$15.12	4.76
	Subtotal	**317.50**	**15.10**	
Airport	Facilities	170.42	$19.35	11.36
	Runways	1,100.96	$0.00	0.00
	Subtotal	**1271.40**	**19.40**	
	Total	**50965.00**	**188.00**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	589.40	$33.67	5.71
	Distribution Lines	862.50	$38.91	4.51
	Subtotal	**1,451.94**	**$72.58**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	1,493.20	$52.70	3.53
	Distribution Lines	517.50	$19.55	3.78
	Subtotal	**2,010.69**	**$72.25**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	1.30	$0.03	2.57
	Distribution Lines	345.00	$6.70	1.94
	Subtotal	**346.30**	**$6.73**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	5.20	$0.18	3.43
	Subtotal	**5.19**	**$0.18**	
Electrical Power	Facilities	5,321.80	$208.13	3.91
	Subtotal	**5,321.80**	**$208.13**	
Communication	Facilities	11.10	$0.55	5.00
	Subtotal	**11.09**	**$0.55**	
	Total	**9,147.01**	**$360.42**	

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Table 14. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of $)

LOSS		Total	%
First Year			
	Employment Impact	2,053,169	64.19
	Income Impact	5,443	3.61
Second Year			
	Employment Impact	886,723	27.72
	Income Impact	3,263	2.17
Third Year			
	Employment Impact	21,528	0.67
	Income Impact	793	0.53
Fourth Year			
	Employment Impact	1,214	0.04
	Income Impact	(148)	-0.10
Fifth Year			
	Employment Impact	70	0.00
	Income Impact	(201)	-0.13
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(204)	-0.14

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Appendix A: County Listing for the Region

Los Angeles,CA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
California	Los Angeles	9,519,338	522,619	168,306	690,925
Total State		**9,519,338**	**522,619**	**168,306**	**690,925**
Total Region		**9,519,338**	**522,619**	**168,306**	**690,925**

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Risk Analysis

Risk analysis is the third phase of a hazard assessment. Risk analysis involves estimating the damage and costs likely to be experienced in a geographic area over a period of time. Factors included in assessing earthquake risk, include population and property distribution in the hazard area, the frequency of earthquake events, landslide susceptibility, buildings, infrastructure, and disaster preparedness of the region. This type of analysis can generate estimates of the damages to the region due to an earthquake event in a specific location. FEMA's software program, HAZUS, uses mathematical formulas and information about building stock, local geology and the location and size of potential earthquakes, economic data, and other information, to estimate losses from a potential earthquake.

The HAZUS reports and maps above were extracted from the County of Los Angeles All-Hazards Mitigation Plan (2014).

For greater Southern California there are multiple worst case scenarios, depending on which fault might rupture, and which communities are in proximity to the fault. But damage will not necessarily be limited to immediately adjoining communities. Depending on the hypocenter of the earthquake, seismic waves may be transmitted through the ground to unsuspecting communities. In the 1994 Northridge Earthquake, Santa Monica suffered extensive damage, even though there was a range of mountains between it and the origin of the earthquake.

Damages for a large earthquake almost anywhere in Southern California are likely to run into the billions of dollars. Although building codes are some of the most stringent in the world, tens of thousands of older existing buildings were built under much less rigid codes. California has laws affecting un-reinforced masonry buildings (URM's) and although many building owners have retrofitted their buildings, hundreds of pre-1933 buildings still have not been brought up to current standards.

Non-structural bracing of equipment and contents is often the most cost-effective type of seismic mitigation. Inexpensive bracing and anchoring may be the most cost effective way to protect expensive equipment. Non-structural bracing of equipment and furnishings will also reduce the chance of injury for the occupants of a building.

Community Earthquake Issues

What is Susceptible to Earthquakes?

Earthquake damage occurs because humans have built structures that cannot withstand severe shaking. Buildings, airports, schools, and lifelines (highways and utility lines) suffer damage in earthquakes and can cause death or injury to humans. The welfare of homes, major businesses, and public infrastructure is very important. Addressing the reliability of buildings, critical facilities, and infrastructure, and understanding the potential costs to government, businesses, and individuals as a result of an earthquake, are challenges faced by the City.

Dams

The Whittier Narrows Dam is located approximately 4 miles northwest of the City center. It is west of the San Gabriel River flood control channel and the Freeway (SR-605). The dam holds

9.75 million gallons of water. According to the City's General Plan, inundation from flood waters released from the Whittier Narrows Dam includes a limited area of low populated areas in the northwest corner of the city (essentially the City's Wellfield and water pumping plant). Flooding from city reservoirs can be prevented by the construction of earthquake resistant dams and reservoirs.

There are a total of 103 dams in Los Angeles County, owned by 23 agencies or organizations, ranging from the Federal government to homeowner associations. These dams hold billions of gallons of water in reservoirs. Releases of water from the major reservoirs are designed to protect Southern California from flood waters and to store domestic water. Seismic activity can compromise the dam structures, and the resultant flooding could cause catastrophic flooding. Following the 1971 Sylmar Earthquake the Lower Van Norman Dam showed signs of structural compromise, and tens of thousands of persons had to be evacuated until the dam could be drained. The dam has never been refilled.

Because of the current design and construction practices, as well as ongoing programs of review and modification, catastrophic dam failure is considered unlikely to impact Whittier. Many flood control channels are expected to suffer damage.

Buildings

The built environment is susceptible to damage from earthquakes. Buildings that collapse can trap and bury people. Lives are at risk, and the cost to clean up the damages is great. In the City of Whittier many buildings were built before 1993 when building codes were not as strict. In addition, retrofitting is not required except under certain conditions and can be expensive. Therefore, the number of buildings at risk remains high. The California Seismic Safety Commission makes annual reports on the progress of the retrofitting of unreinforced masonry buildings. Unreinforced masonry (URM) buildings are examined on as "as known" basis during the permitting process. No City-wide inventories of unreinforced masonry buildings have been conducted in the past.

Infrastructure and Communication

Residents in the City of Whittier commute frequently by automobiles and public transportation such as buses and light rail. An earthquake can greatly damage bridges and roads, hampering emergency response efforts and the normal movement of people and goods. Damaged infrastructure strongly affects the economy of the community because it disconnects people from work, school, food, and leisure, and separates businesses from their customers and suppliers.

System failure, overloads, loss of electrical power, and possible failure of some alternate power systems will likely affect telephone systems. Immediately after the event, numerous failures will occur as well as system overloads. This will disable an estimated 80% of the telephone system for one day.

Radio systems are expected to be 40-75% effective, and microwave systems may be effective as little as 30% or less.

It is expected that 21 of the 59 railroad route segments serving the Southern California region could be unavailable for post-earthquake service. These 21 segments all include major

connections with the north. This includes Metrolink and Union Pacific lines that pass through Whittier. The post-earthquake capacity to serve both Los Angeles and Orange County areas would be very small – probably no more than five trains per day. This is a dramatic decrease from the normal 120-140 trains that currently run through the same area. Additionally, many railroad bridges are highly susceptible to damage because of age, design, and construction. The likelihood of highway bridge collapse could also affect the ability of trains to service nearby areas.

Bridge Damage

Even modern bridges can sustain damage during earthquakes, leaving them unsafe for use. Some bridges have failed completely due to strong ground motion. Bridges are a vital transportation link - with even minor damages, making some areas inaccessible. Because bridges vary in size, materials, location and design, any given earthquake will affect them differently. Bridges built before the mid-1970' s have a significantly higher risk of suffering structural damage during a moderate to large earthquake compared with those built after 1980 when design improvements were made.

Much of the interstate highway system was built in the mid to late 1960's. The bridges in the City of Whittier are state, county or privately owned (including railroad bridges). Caltrans has retrofitted most bridges on the freeway systems; however there are still some county maintained bridges that are not retrofitted. The FHWA requires that bridges on the National Bridge Inventory be inspected every 2 years. Caltrans checks when the bridges are inspected because they administer the Federal funds for bridge projects.

Damage to the San Bernardino Freeway - Interstate 10, and the Foothill Freeway - Interstate 210, is expected to be major. Any inner surface transportation routes could be subject to delays and detours. A major portion of surface streets in the vicinity of freeways will be blocked due to collapsed overpasses. Many surface streets in the older central business districts will be blocked by debris from buildings, falling electrical wires, and pavement damage.

Damage to Lifelines

Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, and electricity and communication networks. Ground shaking and amplification can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services.

Lifelines need to be usable after earthquake to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public.

Disruption of Critical Services

Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after an earthquake event. Some of Whittier's critical facilities are housed in older buildings, though they are up to current seismic codes. See below for additional information pertaining to hospitals.

Individual Preparedness

Because the potential for earthquake occurrences, and earthquake related property damage, is relatively high in Los Angeles County, increasing individual preparedness is a significant need. Strapping down heavy furniture, water heaters, and expensive personal property, as well as being earthquake- insured, and anchoring buildings to foundations, are just a few steps individuals can take to prepare for an earthquake.

Death and Injury

Death and injury can occur both inside and outside of buildings due to collapsed buildings, falling equipment, furniture, debris, and structural materials. Downed power lines and broken water and gas lines can also endanger human life.

Fire

Downed power lines or broken gas mains can trigger fires. When fire stations suffer building or lifeline damage, quick response to extinguish fires is less likely. Furthermore, major incidents demand a larger share of resources, and initially smaller fires and problems receive little or insufficient resources in the initial hours after a major earthquake event.

Loss of electricity may cause a loss of water pressure in some communities, further hampering firefighting ability.

Debris

After damage to a variety of structures, much time is spent cleaning up brick, glass, wood, steel or concrete building elements, office and home contents, and other materials. Developing a strong debris management strategy is essential in post-disaster recovery, especially because the City owns and operates its own solid waste landfill. Disasters do not exempt the City of Whittier from compliance with AB 939: Integrated Waste Management Act, which mandates reduction of waste being disposed.

Existing Mitigation Activities

Existing mitigation activities include current mitigation programs and activities that are implemented by county, regional, state, or federal agencies or organizations.

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City of Whittier Codes
Implementation of earthquake mitigation policy most often takes place at the local government level. The City of Whittier Community Development Department- Building Division enforces building codes pertaining to earthquake hazards.

The following sections of the UBC address the earthquake hazard:
1605.2.1 (Distribution of Horizontal Shear);
1605. 2 (Stability against Overturning);
1605.2.3 (Anchorage);
1626 (Seismic);

1632, 1633, 1633.9 deal with specific earthquake hazards;
1809 (Liquefaction, Anchorage); and
2320 (Distribution of Horizontal Shear)

Additionally, the City has implemented basic building requirements that are above and beyond what the State demands for hazard mitigation. Newly constructed buildings in Whittier that are built in an area subject to earthquake-induced landslide or liquefaction are typically built with extra foundation support. Such support is found in the post-tension reinforced concrete foundation; this same technique is used by coastal cities to prevent home destruction during cases of liquefaction. The City of Whittier goes above and beyond normal building requirements to better protect at-risk areas.

Generally, these codes seek to discourage development in areas that could be prone to flooding, landslide, wildfire and / or seismic hazards; and where development is permitted, that the applicable construction standards are met. Developers in hazard-prone areas may be required to retain a qualified professional engineer to evaluate level of risk on the site and recommend appropriate mitigation measures.

Coordination among Building Officials

The City of Whittier Building Code sets the minimum design and construction standards for new buildings. In 2003, the City adopted the most recent seismic standards in its building code, which requires that new buildings be built at a higher seismic standard.

Since 2003 the City also requires that site-specific seismic hazard investigations be performed for new essential facilities, major structures, hazardous facilities, and special occupancy structures such as schools, hospitals, and emergency response facilities.

Businesses/Private Sector

Seismic activity can cause great loss to businesses, both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Seismic activity can create economic loss that presents a burden to large and small shop owners who may have difficulty recovering from their losses.

Forty percent of businesses do not reopen after a disaster, and another twenty-five percent fail within one year, according to FEMA. Similar statistics from the U.S. Small Business Administration indicate that over ninety percent of businesses fail within two years after being struck by a disaster.

Hospitals

There are two hospitals in Whittier. The Whittier Medical Center is located near Colima Road and Whittier Boulevard. The Presbyterian Intercommunity Hospital is located on Washington Boulevard near Whittier Boulevard.

The “Alfred E. Alquist Hospital Seismic Safety Act” (“Hospital Act”) was enacted in 1973 in response to the moderate Magnitude 6.6 Sylmar Earthquake in 1971 when four major hospital

campuses were severely damaged and evacuated. Two hospital buildings collapsed killing forty-seven people. Three others were killed in another hospital that nearly collapsed.

In approving the Act, the Legislature noted that: "Hospitals, that house patients who have less than the capacity of normally healthy persons to protect themselves, and that must be reasonably capable of providing services to the public after a disaster, shall be designed and constructed to resist, insofar as practical, the forces generated by earthquakes, gravity and winds." (Health and Safety Code Section 129680)

When the Hospital Act was passed in 1973, the State anticipated that, based on the regular and timely replacement of aging hospital facilities, the majority of hospital buildings would be in compliance with the Act's standards within 25 years. However, hospital buildings were not, and are not, being replaced at that anticipated rate. In fact, the great majority of the State's urgent care facilities are now more than 40 years old.

The moderate Magnitude 6.7 Northridge Earthquake in 1994, caused $3 billion in hospital-related damage and evacuations. Twelve hospital buildings constructed before the Act were cited (red tagged) as unsafe for occupancy after the earthquake. Those hospitals that were built in accordance with the 1973 Hospital Act were very successful in resisting structural damage. However, nonstructural damage (for example, plumbing and ceiling systems) was extensive in those post-1973 buildings. Senate Bill 1953 (SB 1953), enacted in 1994 after the Northridge Earthquake, expanded the scope of the 1973 Hospital Act. Under SB 1953, all hospitals are required, as of January 1, 2008, to survive earthquakes without collapsing or posing the threat of significant loss of life. The 1994 Act further mandates that all existing hospitals be seismically evaluated, and retrofitted, if needed, by 2030, so that they are in substantial compliance with the Act (which requires that the hospital buildings be reasonably capable of providing services to the public after disasters). SB 1953 applies to all urgent care facilities (including those built prior to the 1973 Hospital Act) and affects approximately 2,500 buildings on 475 campuses.

SB 1953 directed the Office of Statewide Health Planning and Development ("OSHPD"), in consultation with the Hospital Building Safety Board, to develop emergency regulations including "…earthquake performance categories with sub gradations for risk to life, structural soundness, building contents, and nonstructural systems that are critical to providing basic services to hospital inpatients and the public after a disaster." (Health and Safety Code Section 130005)

The Seismic Safety Commission Evaluation of the State's Hospital Seismic Safety Policies

In 2001, recognizing the continuing need to assess the adequacy of policies, and the application of advances in technical knowledge and understanding, the California Seismic Safety Commission created an Ad Hoc Committee to re-examine the compliance with the Alquist Hospital Seismic Safety Act. The formation of the Committee was also prompted by the recent evaluations of hospital buildings reported to OSHPD that revealed that a large percentage (40%) of California's operating hospitals are in the highest category of collapse risk.

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California Earthquake Mitigation Legislation

California is painfully aware of the threats it faces from earthquakes. Dating back to the 19th century, Californians have been killed, injured, and lost property as a result of earthquakes. As

the State's population continues to grow, and urban areas become even denser, the risk will continue to increase. For decades the Legislature has passed laws to strengthen the built environment and protect the residents.

Table: Sampling of Earthquake Laws in California provides a sampling of some of Earthquake laws in California.

Table: Sampling of Earthquake Laws in California
(Source: http://www.leginfo.ca.gov/calaw.html)

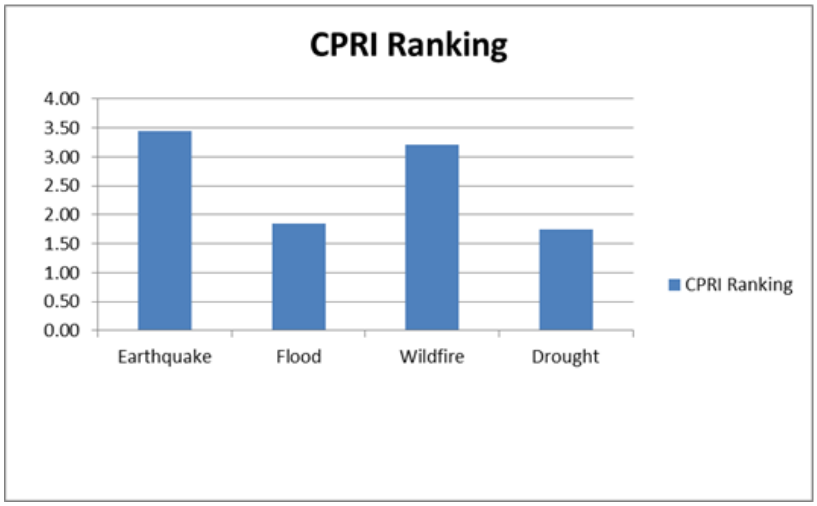
Code Section	Description
Government Code Section 8870-8870.95	Creates Seismic Safety Commission.
Government Code Section 8876.1-8876.10	Established the California Center for Earthquake Engineering Research.
Public Resources Code Section 2800-2804.6	Authorized a prototype earthquake prediction system along the central San Andreas fault near the City of Parkfield.
Public Resources Code Section 2810-2815	Continued the Southern California Earthquake Preparedness Project and the Bay Area Regional Earthquake Preparedness Project.
Health and Safety Code Section 16100-16110	The Seismic Safety Commission and State Architect will develop a state policy on acceptable levels of earthquake risk for new and existing state-owned buildings.
Government Code Section 8871-8871.5	Established the California Earthquake Hazards Reduction Act of 1986.
Health and Safety Code Section 130000-130025	Defined earthquake performance standards for hospitals.
Public Resources Code Section 2805-2808	Established the California Earthquake Education Project.
Government Code Section 8899.10-8899.16	Established the Earthquake Research Evaluation Conference.
Public Resources Code Section 2621-2630 2621.	Established the Alquist-Priolo Earthquake Fault Zoning Act.
Government Code Section 8878.50-8878.52 8878.50.	Created the Earthquake Safety and Public Buildings Rehabilitation Bond Act of 1990.
Education Code Section 35295-35297 35295.	Established emergency procedure systems in kindergarten through grade 12 in all the public or private schools.
Health and Safety Code	Established standards for seismic retrofitting of

Code Section	Description
Section 19160-19169	unreinforced masonry buildings.
Health and Safety Code Section 1596.80-1596.879	Required all child day care facilities to include an Earthquake Preparedness Checklist as an attachment to their disaster plan.

Earthquake Education

Earthquake research and education activities are conducted at several major universities in the Southern California region, including Cal Tech, USC, UCLA, UCI, and UCSB. The local clearinghouse for earthquake information is the Southern California Earthquake Center (SCEC) located at the University of Southern California, Los Angeles, CA 90089, Telephone: (213) 740-5843, Fax: (213) 740-0011, Email: SCEinfo@usc.edu, Website: http://www.scec.org. SCEC is a community of scientists and specialists who actively coordinate research on earthquake hazards at nine core institutions, and communicate earthquake information to the public. SCEC is a National Science Foundation (NSF) Science and Technology Center and is co-funded by the United States Geological Survey (USGS).

Section 5: Flood Hazards



Previous Occurrences of Flooding in the City of Whittier*

The City of Whittier most recently experienced destruction due to flooding in 1995, impacting various areas city-wide. In addition to flooding and damage, storms were responsible for large volumes of debris. The City sought and received a Presidential Disaster Declaration to obtain federal assistance for its recovery effort. This flooding event caused $15,000 worth of damage to public facilities.

Since the writing of the 2010 Mitigation Plan, there have been no significant flooding events in the City of Whittier.

Historic Flooding in Southern California

Los Angeles County records reveal since 1861, the Los Angeles River has flooded 30 times, on average once every 6.1 years. But averages are deceiving, for the Los Angeles basin goes through periods of drought and then periods of above average rainfall. Between 1889 and 1891 the river flooded every year, from 1941 to 1945, the river flooded 5 times. Conversely, from 1896 to 1914, and again from 1944 to 1969, a period of 25 years, the river did not have serious floods.

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* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2**

B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

Average annual precipitation in Los Angeles County ranges from 13 inches on the coast to approximately 40 inches on the highest point of the Peninsular Mountain Range that transects the county. Several factors determine the severity of floods, including rainfall intensity and duration. A large amount of rainfall over a short time span can result in flash flood conditions. A sudden thunderstorm or heavy rain, dam failure, or sudden spills can cause flash flooding. The National Weather Service's definition of a flash flood is a flood occurring in a watershed where the time of travel of the peak of flow from one end of the watershed to the other is less than six hours.

The towering mountains that give the Los Angeles region its spectacular views also wring a great deal of rain out of the storm clouds that pass through. Because the mountains are so steep, the rainwater moves rapidly down the slopes and across the coastal plains on its way to the ocean.

"The Santa Monica, Santa Susana and Verdugo Mountains, which surround three sides of the valley, seldom reach heights above three thousand feet. The western San Gabriel Mountains, in contrast, have elevations of more than seven thousand feet. These higher ridges often trap eastern-moving winter storms. Although downtown Los Angeles averages just fifteen inches of rain a year, some mountain peaks in the San Gabriel's receive more than forty inches of precipitation annually, as much as many locations in the humid eastern United States" (Source: The Los Angeles River: It's Life, Death, and Possible Rebirth, Gumprecht 2001).

Naturally, this rainfall moves rapidly downstream, often with severe consequences for anything in its path. In extreme cases, flood-generated debris flows will roar down a canyon at speeds near 40 miles per hour with a wall of mud, debris and water, tens of feet high. Flooding occurs when climate, geology, and hydrology combine to create conditions where water flows outside of its usual course.

Table: Historical Records of Large Floods in Los Angeles County (Source: National Climatic Data Center)

Date	Loss Estimation	Source of Estimate	Comments
1995	$50 million	National Oceanic and Atmospheric Association	Flash Flood
1995	$50 thousand	National Oceanic and Atmospheric Association	Flood/Flash Flood
2005	$1 million	National Oceanic and Atmospheric Association	Flash Flood

Flooding Characteristics

Flooding occurs when climate, geology, and hydrology combine to create conditions where water flows outside of its usual course.

Winter Rainfall

Over the last 125 years, the average annual rainfall in Los Angeles County is 14.9 inches. But the term "average" means very little as the annual rainfall during this time period has ranged from only 4.35 inches in 2001-2002 to 38.2 inches in 1883-1884. In fact, in only fifteen of the past 125 years, has the annual rainfall been within plus or minus 10% of the 14.9 inch average. And in only 38 years has the annual rainfall been within plus or minus 20% of the 14.9 inch average. This makes the Los Angeles basin a land of extremes in terms of annual precipitation.

Monsoons

Another relatively regular source for heavy rainfall, particularly in nearby mountains and foothills, is from summer tropical storms. These tropical storms usually coincide with El Niño years.

Flood Risk Factors

El Niño

El Niño is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences. Among these consequences is increased rainfall across the southern tier of the US and in Peru, which has caused destructive flooding, and drought in the West Pacific, sometimes associated with devastating brush fires in Australia. Observations of conditions in the tropical Pacific are considered essential for the prediction of short term (a few months to 1 year) climate variations.

El Niño (Spanish name for the male child), initially referred to a weak, warm current appearing annually around Christmas time along the coast of Ecuador and Peru, and lasting only a few weeks, to a month or more. Every three to seven years, an El Niño event can last for many months, having significant economic and atmospheric consequences worldwide. During the past forty years, ten of these major El Niño events have been recorded, the worst of which occurred in 1997-1998. Previous to this, the El Niño event in 1982-1983 was the strongest. Some of the El Niño events have persisted more than one year.

In August 2015, the Los Angeles Times reported that the strengthening of El Niño conditions in the Pacific Ocean has the potential to become one of the most powerful on record, as warming ocean waters surge toward the Americas, setting up a pattern that could bring once-in-a-generation storms to California late in the fall of 2015 or early winter of 2016, as predicted by the National Weather Service's Climate Prediction Center. A host of observations have led scientists to conclude that "collectively, these atmospheric and oceanic features reflect a significant and strengthening El Niño.

Severity

Floods threaten life and property. People and animals can drown; structures and their contents destroyed; roads, bridges, and railroad tracks can be washed out; and crops ruined. Floods can create health hazards due to the discharge of raw sewage from damaged septic tank leach fields, sewer lines, and sewage treatment plants; or due to hazardous materials carried off by raging waters.

Geography and Geology

Southern California is the product of rainstorms and erosion occurring over millennia. Most of the mountains surrounding the valleys and coastal plain are deeply fractured faults. As the mountains grew taller, their brittle slopes eroded. Rivers and streams carried boulders, rocks, gravel, sand, and silt down these slopes to the valleys and coastal plain. Today, much of the coastal plain rests on the ancient rock debris and sediment washed down from the mountains.

This sediment can act like a sponge, absorbing vast quantities of rain in years when heavy rains follow a dry period. Like a sponge near saturation, the same soil fills up rapidly when heavy rain follows a period of relatively wet weather. Even so, in some years of heavy rain, flooding is minimal because the ground is relatively dry, yet the same amount of rain following a wet period causes extensive flooding.

Essentially all of Los Angeles County is built out leaving little open land to absorb rainfall. The lack of open land forces water to remain on the surface rapidly accumulating. If it were not for the massive flood control system with its concrete lined river and streambeds, flooding would occur more frequently. In addition, the tendency is toward less and less open land. In-fill building is becoming a much more common practice in many areas. Developers tear down an older home, typically covering up to 40 percent of the lot, replacing the single home with three or four town homes or apartments covering 90-95 percent of the lot.

Another potential source of flooding is “asphalt creep”. The street space between the curbs of a street is a part of the flood control system. When water leaves property and accumulates in the street, it is directed toward the underground portion of the flood control system. The carrying capacity of the street is determined by the width of the street and the height of the curbs along the street. Often, when resurfacing streets, a one to two inch layer of asphalt is laid over the existing asphalt. This added layer of asphalt subtracts from the rated capacity of the street to carry water. Thus, the original engineered capacity of the entire storm drain system is marginally reduced over time. Subsequent re-paving of the street will further reduce the engineered capacity even more.

Flood Terminology

Floodplain

A floodplain is a land area adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding. This area, if left undisturbed, acts to store excess flood water. The floodplain is made up of two sections: the floodway and the flood fringe.

100-Year Flood

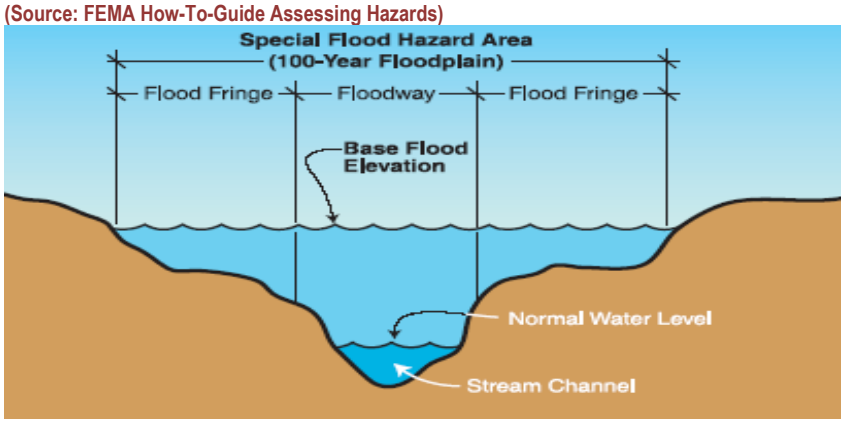
The 100-year flooding event is the flood having a one percent chance of being equaled or exceeded in magnitude in any given year. Contrary to popular belief, it is not a flood occurring once every 100 years. The 100-year floodplain is the area adjoining a river, stream, or watercourse covered by water in the event of a 100-year flood. Schematic: Floodplain

The 100-year flooding event is the flood having a 1% chance of being equaled or exceeded in magnitude in any given year.

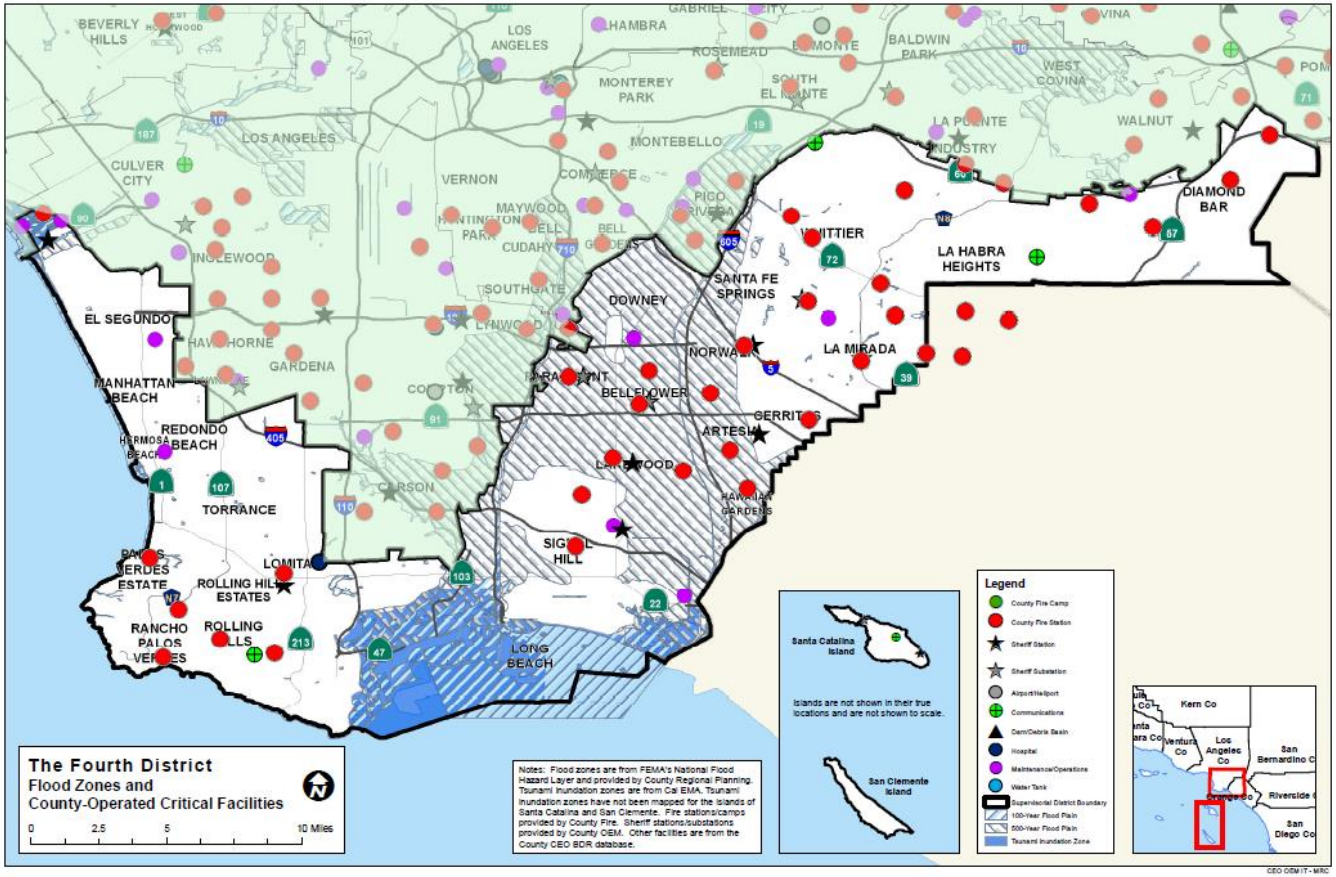
Contrary to popular belief, it is not a flood occurring once every 100 years.

and Floodway shows the relationship of the floodplain and the floodway.

Schematic: Floodplain and Floodway
(Source: FEMA How-To-Guide Assessing Hazards)



Map: Flood Zones and County-Operated Critical Facilities, District 4
(Source: County of Los Angeles Chief Executive Office - GIS)



Floodway

The floodway is one of two main sections that make up the floodplain. Floodways are defined for regulatory purposes. Unlike floodplains, floodways do not reflect a recognizable geologic feature. For NFIP purposes, floodways are defined as the channel of a river or stream, and the overbank areas adjacent to the channel. The floodway carries the bulk of the flood water downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures that would obstruct or divert flood flows onto other properties.

Base Flood Elevation (BFE)

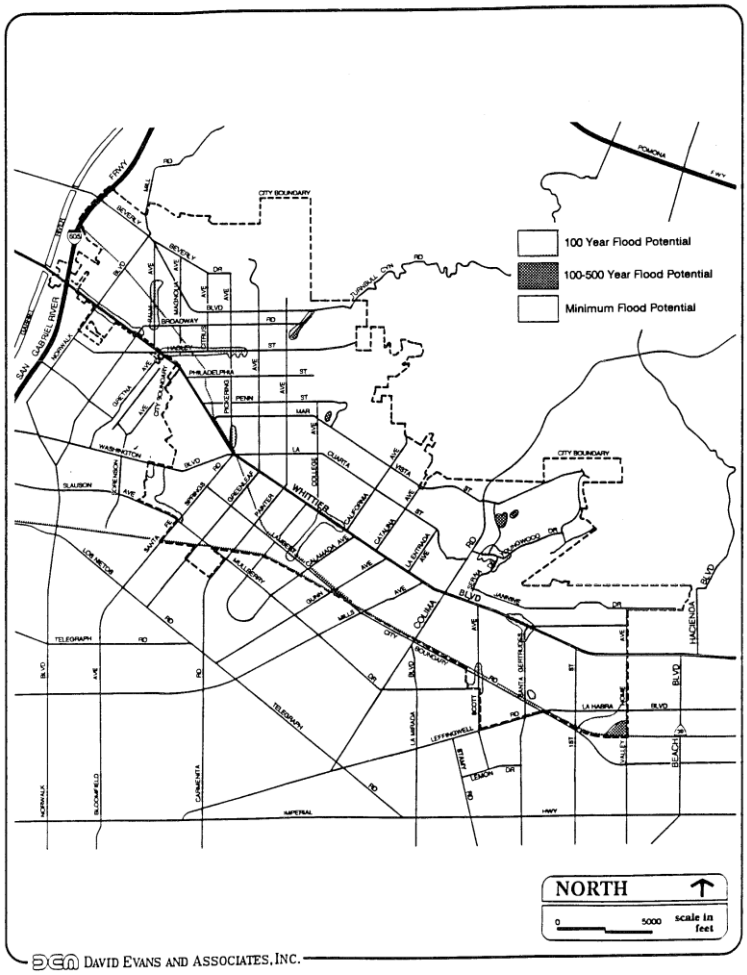
The term "Base Flood Elevation" refers to the elevation (normally measured in feet above sea level) that the base flood is expected to reach. Base flood elevations can be set at levels other than the 100-year flood. Some communities use higher frequency flood events as their base flood elevation for certain activities, while using lower frequency events for others. For example, for the purpose of storm water management, a 25-year flood event might serve as the base flood elevation; while the 500-year flood event serves as base flood elevation for the tie down of mobile homes. The regulations of the NFIP focus on development in the 100-year floodplain.

Types of Flooding

Two types of flooding primarily affect the City of Whittier: slow-rise or flash flooding. Slow-rise floods may be preceded by a warning period of hours or days. Evacuation and sandbagging for slow-rise floods have often effectively lessened flood related damage. Conversely, flash floods are most difficult to prepare for, due to extremely limited, if any, advance warning and preparation time. Unlike most of California, the areas of Los Angeles County that are subject to slow-rise flooding are not associated with overflowing rivers, aqueducts, canals or lakes.

Slow-rise flooding in Whittier has usually resulted from one or a combination of the following factors: extremely heavy rainfall, saturated soil, area recently burned in wild fires with inadequate new ground cover growth, or heavy rainfall with runoff from melting mountain snow.

Map: Whittier Flood Hazards
(Source: City of Whittier Background Report to the General Plan)



Urban Flooding

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water

moves from the clouds, to the ground, and into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in flood waters that rise very rapidly and peak with violent force.

The City has a high concentration of impermeable surfaces that either collect water or concentrate the flow of water in unnatural channels. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with vegetative debris causing additional, localized flooding.

Riverine Flooding

Riverine flooding is the overbank flooding of rivers and streams. The natural processes of riverine flooding add sediment and nutrients to fertile floodplain areas. Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over a wide geographic area, causing flooding in hundreds of smaller streams, which then drain into the major rivers. Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the 100-year flood with flood depths of only one to three feet. These areas are generally flooded by low velocity sheet flows of water.

Dam Failure Flooding

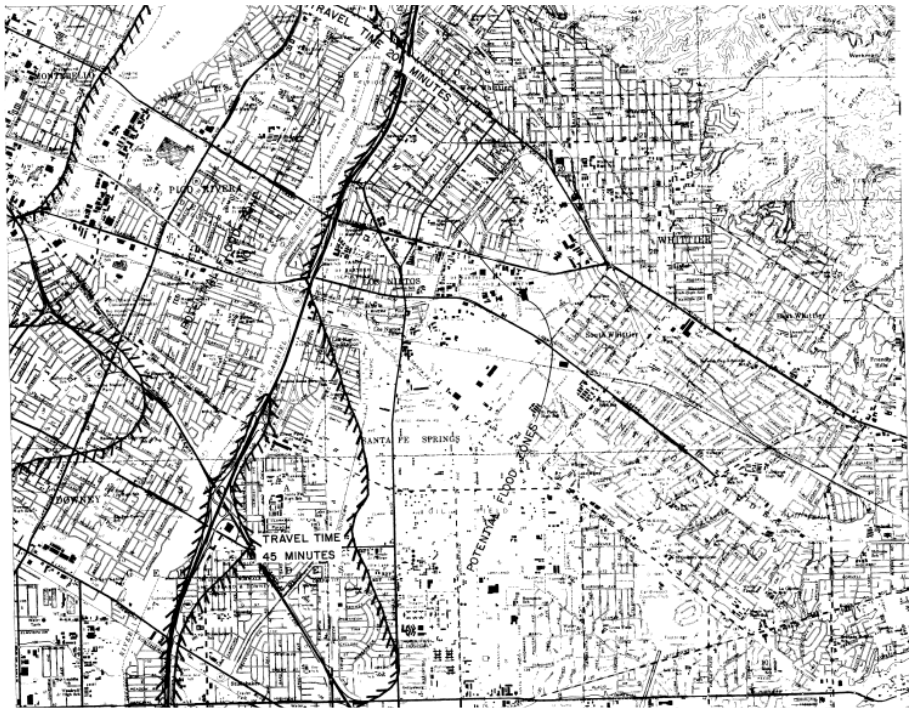
Loss of life and damage to structures, roads, and utilities may result from a dam failure. Economic losses can also result from a lowered tax base and lack of utility profits. As identified in the City's General Plan, within the City limits there are four reservoirs located above the city in the Puente Hills that potentially pose a flood hazard. The other three reservoirs at high elevations are Painter Reservoir, Greenleaf I Reservoir, and Ocean View Reservoir. In addition, there is also the newly constructed Greenleaf II Reservoir. There are several other water tanks located throughout the City, but they pose very minor flood hazards.

The Whittier Narrows Dam is located approximately 4 miles northwest of the City center. It is west of the San Gabriel River flood control channel and the Freeway (SR-605). The dam holds 9.75 million gallons of water. According to the City's General Plan, inundation from flood waters released from the Whittier Narrows Dam includes a limited area of low populated areas in the northwest corner of the City (essentially the City's Wellfield and water pumping plant).

Because dam failure can have severe consequences, FEMA requires that all dam owners develop Emergency Action Plans (EAP) for warning, evacuation, and post-flood actions. Although there may be coordination with county officials in the development of the EAP, the responsibility for developing potential flood inundation maps and facilitation of emergency response is the responsibility of the dam owner.

The potential for Dam inundation resulting from a break in a catastrophic failure of the Whittier Narrows Dam is shown in Map: Whittier Narrow Dam Inundation.

Map: Whittier Narrows Dam Inundation
(Source: California Division of Dam Safety)



What is the Effect of Development on Floods?

When structures or fill are placed in the floodway or floodplain, water is displaced. Development raises the river levels by forcing the river to compensate for the flow space obstructed by the inserted structures and/or fill. When structures or materials are added to the floodway or floodplain and no fill is removed to compensate, serious problems can arise. Flood waters may be forced away from historic floodplain areas. As a result, other existing floodplain areas may experience flood waters that rise above historic levels. Displacement of only a few inches of water can mean the difference between no structural damage occurring in a given flood event, and the inundation of many homes, businesses, and other facilities. Careful attention should be given to development that occurs within the floodway to ensure that structures are prepared to withstand base flood events. In highly urbanized areas, increased paving can lead to an increase in volume and velocity of runoff after a rainfall event, exacerbating the potential flood hazards. Care should be taken in the development and implementation of storm water management systems to ensure that these runoff waters are dealt with effectively.

Flood Insurance Rate Maps (FIRM) and Flood Insurance Studies (FIS) Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements.

How are Flood-Prone Areas Identified?

Flood maps and Flood Insurance Studies (FIS) are often used to identify flood-prone areas. The NFIP was established in 1968 as a means of providing low-cost flood insurance to the nation's flood-prone communities. The NFIP also reduces flood losses through regulations that focus on building codes and sound floodplain management. NFIP regulations (44 Code of Federal Regulations Chapter 1, Section 60, 3) require that all new construction in floodplains must be elevated at or above base flood level.

FIRM and FIS Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A FIRM is the official map produced by FEMA which delineates Special Flood Hazard Area (SFHA) in communities where NFIP regulations apply. FIRMs are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply.

Water surface elevations are combined with topographic data to develop FIRMs. FIRMs illustrate areas that would be inundated during a 100-year flood, floodway areas, and elevations marking the 100-year-flood level. In some cases, they also include BFEs and areas located within the 500-year floodplain.

Flood Insurance Studies and FIRMs produced for the NFIP provide assessments of the probability of flooding at a given location. FEMA conducted many Flood Insurance Studies in the late 1970s and early 1980s. These studies and maps represent flood risk at the point in time when FEMA completed the studies. However, it is important to note that not all 100-year or 500-year floodplains have been mapped by FEMA.

*NFIP Participation**

The City of Whittier participates in NFIP. Unfortunately, FEMA flood maps are not entirely accurate because they are updated so infrequently. These studies and maps represent flood risk at the point in time when FEMA completed the studies, and does not incorporate planning for floodplain changes in the future due to new development. Although FEMA is considering changing that policy, it is optional for local communities. The FEMA FIRM maps for the City of Whittier were last updated in 2009. The FEMA FIRM maps below represent the current status of the FIRM maps. Human-caused and natural changes to the environment have changed the dynamics of storm water run-off since then.

Special Flood Hazard Areas are located at or below a flood elevation that has a one percent or greater probability of being equaled or exceeded during any given year (this is also known as a 100-year flood event). This flood, which is referred to as the base flood, is the national standard on which the floodplain management and insurance requirements of the NFIP are based.

Following is language from the City's Municipal Code relating to development in the floodplain:

> *A development permit shall be obtained before construction or development begins within any area of special flood hazards, established in Section 15.40.070. Applications for a development permit shall be made on forms furnished by the floodplain administrator and may include, but not be limited to plans in duplicate drawn to scale showing the nature, location, dimensions and elevation of the area in question; existing or proposed structures, fill, storage of materials, drainage facilities; and the location of the foregoing. Specifically, the following information is required:*
>
> *A. Proposed elevation in relation to mean sea level, of the lowest floor (including basement) of all structures; in Zone AO or VO, elevation of highest adjacent grade and proposed elevation of lowest floor of all structures;*
> *B. Proposed elevation in relation to mean sea level to which any structure will be floodproofed;*
> *C. All appropriate certifications listed in Section 15.40.150(D) of this article; and*
> *D. Description of the extent to which any watercourse will be altered or relocated as a result of proposed development.*
> *(Ord. 2429 § 4(A), 1988)*

Definitions of FEMA Flood Zone Designations

FEMA has identified three flood zones within the City of Whittier: Zone "A", Zone "B", and Zone "C". See charts below for definitions.

Flood zones are geographic areas that the FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding in the area.

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* **ELEMENT C. MITIGATION STRATEGY | C2**
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))

Moderate to Low Risk Areas

In communities that participate in the NFIP, flood insurance is available to all property owners and renters in these zones:

ZONE	DESCRIPTION
B and X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
C and X (unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.

High Risk Areas

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all of these zones:

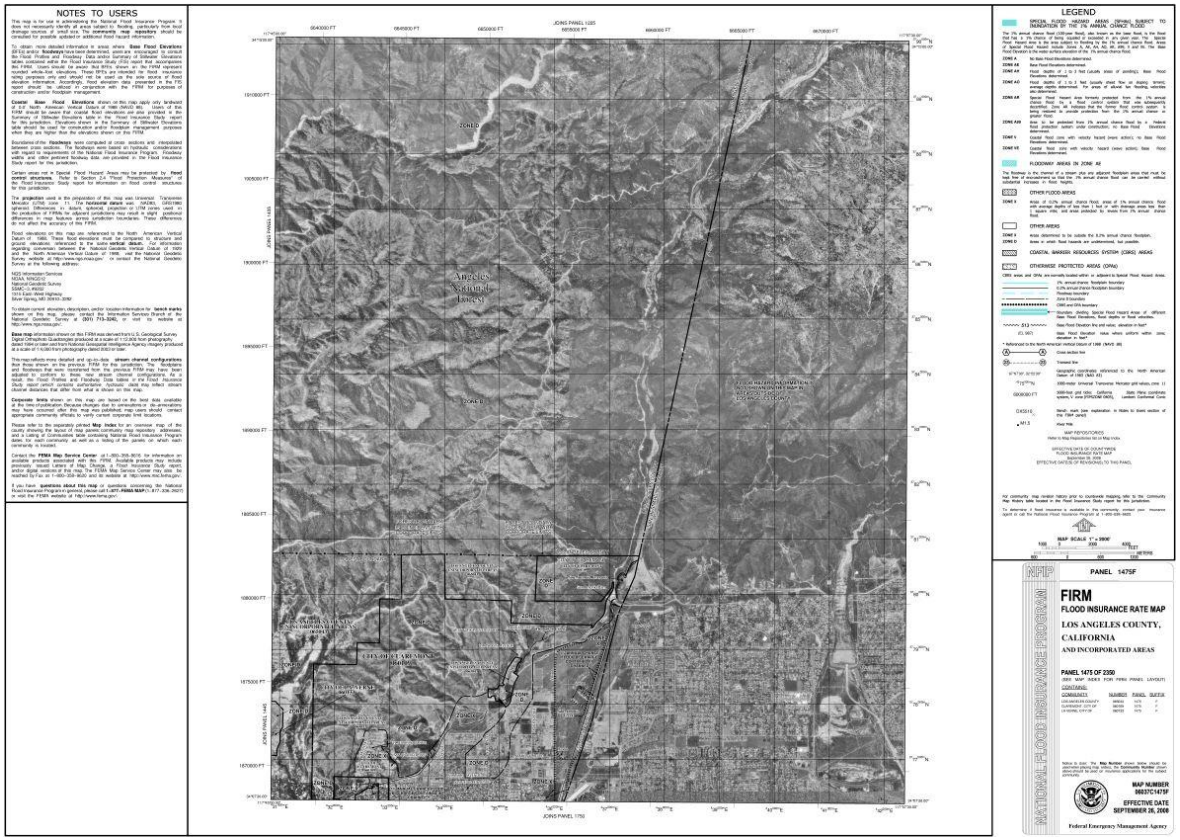
ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.

ZONE	DESCRIPTION
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

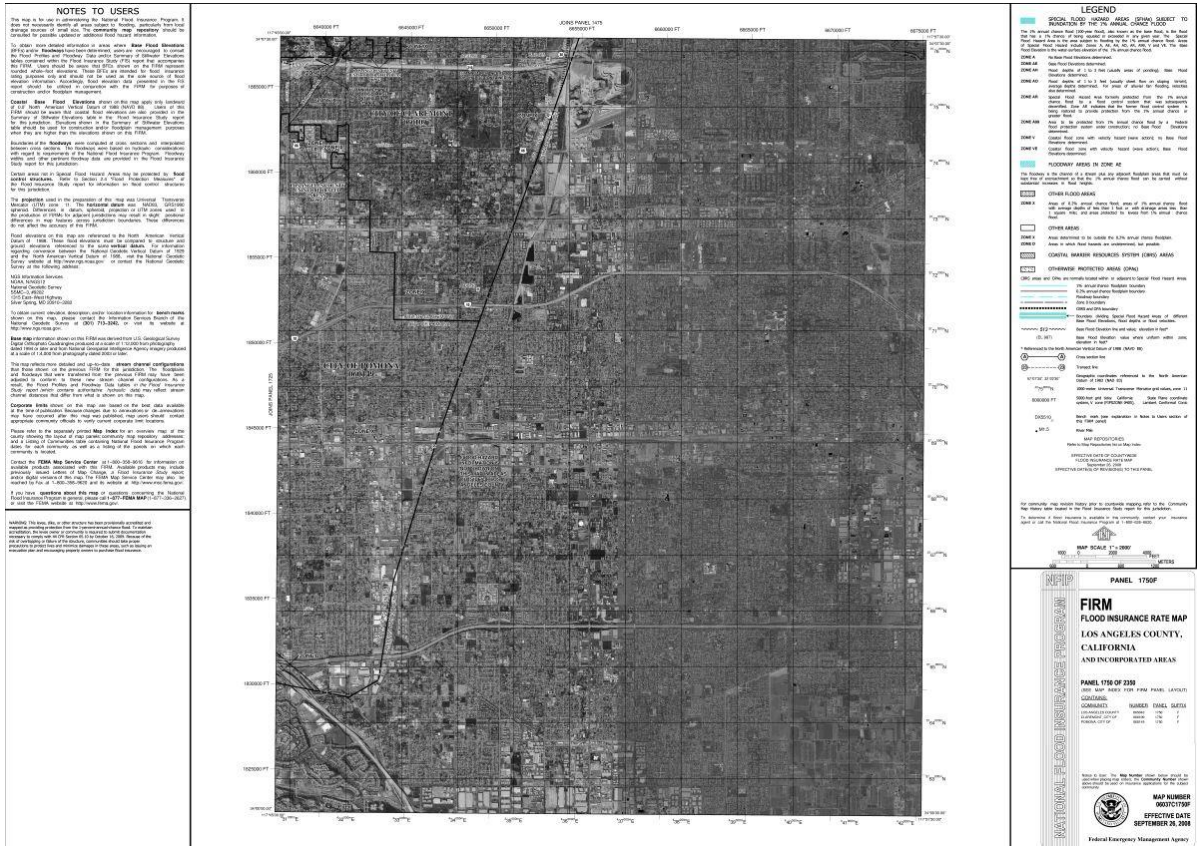
Undetermined Risk Areas

ZONE	DESCRIPTION
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.

Map: Flood Insurance Rate Map 1
(Source: FEMA, NFIP)



Map: Flood Insurance Rate Map 2
(Source: FEMA, NFIP)



Flood Mapping Methods and Techniques

Although many communities rely exclusively on FIRMs to characterize the risk of flooding in their area, there are some flood-prone areas that are not mapped but remain susceptible to flooding. These areas include locations next to small creeks, local drainage areas, and areas susceptible to manmade flooding.

Communities find it particularly useful to overlay flood hazard areas on tax assessment parcel maps. This allows a community to evaluate the flood hazard risk for a specific parcel during review of a development request. Coordination between FEMA and local planning jurisdictions is the key to making a strong connection with GIS technology for the purpose of flood hazard mapping.

Coordination between FEMA and local planning jurisdictions is the key to making a strong connection with GIS technology for the purpose of flood hazard mapping.

Flood Hazard Assessment

Hazard Identification

Hazard identification is the first phase of a hazard assessment. Identification is the process of estimating: 1) the geographic extent of the floodplain (i.e., the area at risk from flooding); 2) the intensity of the flooding that can be expected in specific areas of the floodplain; and 3) the probability of occurrence of flood events. This process usually results in the creation of a floodplain map. Floodplain maps provide detailed information that can assist jurisdictions in making policies and land-use decisions.

Vulnerability Assessment

Vulnerability assessment is the second phase of a flood-hazard assessment. It combines the floodplain boundary, generated through hazard identification, with an inventory of the property within the floodplain. Understanding the population and property exposed to hazards will assist in reducing risk and preventing loss from future events. Because site-specific inventory data and inundation levels given for a particular flood event (10-year, 25-year, 50-year, 100-year, and 500-year) are not readily available, calculating a community's vulnerability to flood events is not straightforward. The amount of property in the floodplain, as well as the type and value of structures on those properties, should be calculated to provide a working estimate for potential flood losses.

Risk Analysis

Risk analysis is the third and most advanced phase of a flood hazard assessment. It builds upon the hazard identification and vulnerability assessment. A flood risk analysis for the City of Whittier should include two components: 1) the life and value of property that may incur losses from a flood event (defined through the vulnerability assessment); and 2) the number and type of flood events expected to occur over time. Within the broad components of a risk analysis, it is possible to predict the severity of damage from a range of events. Flow velocity models assist in predicting the amount of damage expected from different magnitudes of flood events.

Local Conditions

Based on floodplain maps, the areas in Whittier that are more likely to be flooded can be identified. It is also possible to pinpoint the effects of certain flood events on individual properties. At the time of publication of this Plan, data was insufficient to conduct a full risk analysis for flood events in the City of Whittier. Insurance estimates for City-owned property give insight into the potential costs that could be incurred should severe flooding occur. This Plan includes recommendations for building partnerships that will support the development of a flood risk analysis in the City of Whittier.

The size and frequency of a flood in a particular area, depends on a complex combination of conditions, including the amount, intensity, and distribution of rainfall previous moisture condition and drainage patterns.

The magnitude of a flood is measured in terms of its peak discharge, which is the maximum volume of water passing a point along a channel in a given amount of time, usually expressed in cubic feet per second (cfs). Floods are usually referred to in terms of their chance of occurrence. For example, a 100-year flood has a 1% chance of occurring in any given year.

The Federal Emergency Management Agency (FEMA) establishes base flood heights and inundation areas for 100-year and 500-year flood zones. The 100-year flood zone is defined as the area that could be inundated by the flood which has a one percent probability of occurring in any given year. The 500-year flood is defined as the flood which has a 0.2 percent probability of occurring in any given year.

The City participates in the National Flood Insurance Program (NFIP). Created by Congress in 1968, the NFIP makes flood insurance available in communities that enact minimum floodplain management rules consistent with the Code of Federal Regulations §60.3.

Impact of Flooding in the City of Whittier*

Floods and their impacts vary by location and severity of any given flood event, and likely only affect certain areas of the county during specific times. Based on the risk assessment, it is evident that floods will continue to have devastating economic impact to certain areas of the City.

Impact that is not quantified, but anticipated in future events includes:

- ✓ Injury and loss of life;
- ✓ Commercial and residential structural damage;
- ✓ Disruption of and damage to public infrastructure;
- ✓ Secondary health hazards e.g. mold and mildew
- ✓ Damage to roads/bridges resulting in loss of mobility
- ✓ Significant economic impact (jobs, sales, tax revenue) upon the community

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* ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))

- ✓ Negative impact on commercial and residential property values and
- ✓ Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.

Property Loss Resulting from Flooding Events

The type of property damage caused by flood events depends on the depth and velocity of the flood waters. Faster moving flood waters can wash buildings off their foundations and sweep cars downstream. Pipelines, bridges, and other infrastructure can be damaged when high waters combine with flood debris. Extensive damage can be caused by basement flooding and landslide damage related to soil saturation from flood events. Most flood damage is caused by water saturating materials susceptible to loss (i.e., wood, insulation, wallboard, fabric, furnishings, floor coverings, and appliances). In many cases, flood damage to homes renders them unlivable.

*Repetitive Loss Properties**

Repetitive Loss Properties (RLPs) are most susceptible to flood damages; therefore, they have been the focus of flood hazard mitigation programs. Unlike a countywide program, the Floodplain Management Plan (FMP) for repetitive loss properties involves highly diversified property profiles, drainage issues, and property owner's interest. It also requires public involvement processes unique to each RLP area. The objective of an FMP is to provide specific potential mitigation measures and activities to best address the problems and needs of communities with repetitive loss properties. A repetitive loss property is one for which two or more claims of $1,000 or more have been paid by the National Flood Insurance Program (NFIP) within any given ten-year period. According to FEMA and the County of Los Angeles Flood Mitigation Plan, there are no Repetitive Loss Properties within the City of Whittier.

Business/Industry

Flood events impact businesses by damaging property and by interrupting business. Flood events can cut off customer access to a business as well as close a business for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures.

Public Infrastructure

Publicly owned facilities are a key component of daily life for all citizens of the county. Damage to public water and sewer systems, transportation networks, flood control facilities, emergency facilities, and offices can hinder the ability of the government to deliver services. Government can take action to reduce risk to public infrastructure from flood events, as well as craft public policy that reduces risk to private property from flood events.

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* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B4**
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

Roads

During hazard events, or any type of emergency or disaster, dependable road connections are critical for providing emergency services. Roads systems in Whittier are maintained by multiple jurisdictions. Federal, state, county, and city governments all have a stake in protecting roads from flood damage. Road networks often traverse floodplain and floodway areas. Transportation agencies responsible for road maintenance are aware of roads at risk from flooding.

Bridges

Bridges are key points of concern during flood events because they are important links in road networks and they can be obstructions in watercourses, inhibiting the flow of water during flood events. The bridges in Whittier are state, county, city, or privately owned. A state-designated inspector must inspect all state, county and city bridges every two years; but private bridges are not inspected, and can be very dangerous. The inspections are rigorous, looking at everything from seismic capability to erosion and scour.

Storm Water Systems

Local urban flooding and isolated drainage problems are common throughout the Whittier. The City's Public Works Department staff is aware of local drainage threats. The problems are often present where storm water runoff enters culverts or goes underground into storm sewers. Inadequate maintenance can also contribute to the flood hazard in the urbanized areas.

Debris in the Storm Drains

Storm water pollution is urban runoff water that picks up pollutants as it flows through the storm drain system – a network of channels, gutters and pipes that collect runoff from city streets, neighborhoods, agricultural areas, construction sites and parking lots – and empties directly into local waterways. Unlike sewage, which goes to treatment plants, urban runoff flows untreated through the storm drain system. Anything thrown, swept or poured into the street, gutter or a catch basin – the curbside openings that lead into the storm drain system – can flow directly into our channels, creeks, bays and ocean. This includes pollutants like trash, pet waste, cigarette butts, motor oil, anti-freeze, runoff from pesticides and fertilizers, paint from brushes and containers rinsed in the gutter, and toxic household chemicals.

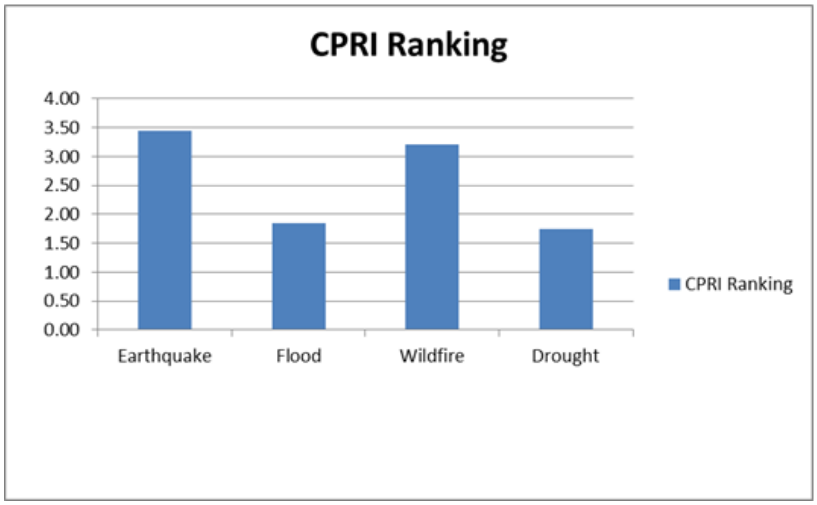
Water/Wastewater Treatment Facilities

The City of Whittier receives its water services from its own water system for most of the City as well as Suburban Water Company. Wastewater treatment services are provided at the Los Coyotes Treatment Facility run by the Los Angeles County Sanitation Districts.

Water Quality

Environmental quality problems include bacteria, toxins, and pollution. The City of Whittier has high levels of nitrates within the water system from time to time but always within regulatory limits.

Section 6: Wildfire Hazards



Previous Occurrences of Wildfires in the City of Whittier*

Wildfires present a substantial hazard to life and property in communities built within or adjacent to hillsides and mountainous along Whittier's northern boundary.

In the fall of 1967, hills near Whittier College experienced wildfire that advanced to within one hill away from the College. There was severe smoke and roads were closed, but there were no structures involved. In the early 1980's, Turnbull Canyon in the Puente Hills experienced wildfire, but no homes were lost. Turnbull Canyon again experienced wildfire in 1990. The houses that were lost were in the unincorporated county area of Hacienda Heights.

Since the writing of the 2010 Mitigation Plan, there have been no significant wildfire events in the City of Whittier.

Why are Wildfires a Threat to the City of Whittier?

A wildfire is an uncontrolled fire spreading through vegetative fuels and exposing or possibly consuming structures. They often begin unnoticed and spread quickly. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires. A wildland fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines and similar facilities. A Wildland/Urban Interface Fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels.

* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2**

B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

People start more than 80 percent of wildfires, usually as debris burns, arson, or carelessness. Lightning strikes are the next leading cause of wildfires. Wildfire behavior is based on three primary factors: fuel, topography, and weather. The type, and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential and behavior. The continuity of fuels, expressed in both horizontal and vertical components is also a determinant of wildfire potential and behavior. Topography is important because it affects the movement of air (and thus the fire) over the ground surface. The slope and shape of terrain can change the speed at which the fire travels, and the ability of firefighters to reach and extinguish the fire. Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity and wind (both short and long term) affect the severity and duration of wildfires. Los Angeles County's topography, consisting of a semi-arid coastal plain and rolling highlands, when fueled by shrub overgrowth, occasional Santa Ana winds and high temperatures, creates an ever-present threat of wildland fire. Extreme weather conditions such as high temperature, low humidity, and/or winds of extraordinary force may cause an ordinary fire to expand into one of massive proportions.

For thousands of years, fires have been a natural part of the ecosystem in Southern California. However, wildfires present a substantial hazard to life and property in communities built within or adjacent to hillsides and mountainous areas. There is a huge potential for losses due to wildland/urban interface fires in Southern California. According to the California Division of Forestry (CDF), there were over seven thousand reportable fires in California in 2003, with over one million acres burned. According to CDF statistics, in the October 2003 Firestorms, over 4,800 homes were destroyed and 24 lives were lost.

In late October 2007, Southern California experienced an unusually severe fire weather event characterized by intense, dry, gusty Santa Ana winds. This weather event drove a series of destructive wildfires that took a devastating toll on people, property, natural resources, and infrastructure. Although some fires burned into early November, the heaviest damage occurred during the first three days of the siege when the winds were the strongest.

The 2009 Station Fire was the most recent wildfire to impact the Los Angeles region. Although there was no damage or impact to the City of Whittier, costs included personnel responses in the form of mutual aid.

Historic Fires in Southern California

Large fires have been part of the Southern California landscape for millennia. Written documents reveal that during the 19th century human settlement of southern California altered the fire regime of coastal California by increasing the fire frequency. This was an era of very limited fire suppression, and yet like today, large crown fires covering tens of thousands of acres

were not uncommon. One of the largest fires in Los Angeles County (60,000 acres) occurred in 1878.

Table: Southern California's Largest Wildfires
(Source: CALFIRE Top 20 Largest California Wildfire 2014)

Destructive Fires in California History					
Fire Name	**Date**	**County**	**Acres**	**Structures**	**Deaths**
Cedar	October 2003	San Diego	273,246	2,820	14
Zaca	July 2007	Santa Barbara	240,207	1	0
Matilija	September 1932	Ventura	220,000	0	0
Witch	October 2007	San Diego	197,990	1,650	2
Laguna	September 1970	San Diego	175,425	382	5
Day	September 2006	Ventura	162,702	11	0
Station	August 2009	Los Angeles	160,557	209	2
Wheeler	July 1985	Ventura	118,000	26	0
Simi	October 2003	Ventura	108,204	300	0

The 2003 Southern California Fires

The fall of 2003 marked the most destructive wildfire season in California history. In a ten day period, 12 separate fires raged across Southern California in Los Angeles, Riverside, San Bernardino, San Diego and Ventura counties. The massive "Cedar Fire" in San Diego County alone consumed 2,800 homes and burned over a quarter of a million acres.

In October 2003, Southern California experienced the most devastating wildland fire disaster in state history. Over 739,597 acres burned; 3,631 homes, 36 commercial properties, and 1,169 outbuildings were destroyed; 246 people were injured; and 24 people died, including one

firefighter. At the height of the siege, 15,631 personnel were assigned to fight the fires. (Source: State of California, *Governor's Blue Ribbon Panel Fire Commission Report to the Governor*, 2004)

Table: October 2003 Firestorm Statistics
(Source: http://www.fire.ca.gov/php/fire_er_content/downloads/2003LargeFires.pdf)

County	Fire Name	Date Began	Acres Burned	Homes Lost	Homes Damaged	Lives Lost
Riverside	Pass	10/21/03	2,397	3	7	0
Los Angeles	Padua	10/21/03	10,446	59	0	0
San Bernardino	Grand Prix	10/21/03	69,894	136	71	0
San Diego	Roblar 2	10/21/03	8,592	0	0	0
Ventura	Piru	10/23/03	63,991	8	0	0
Los Angeles	Verdale	10/24/03	8,650	1	0	0
Ventura	Simi	10/25/03	108,204	300	11	0
San Diego	Cedar	10/25/03	273,246	2,820	63	14
San Bernardino	Old	10/25/03	91,281	1,003	7	6
San Diego	Otay / Mine	10/26/03	46,000	6	11	0
Riverside	Mountain	10/26/03	10,000	61	0	0
San Diego	Paradise	10/26/03	56,700	415	15	2
Total Losses			**749,401**	**4,812**	**185**	**22**

The 2007 Southern California Fires

In late October 2007, Southern California experienced an unusually severe fire weather event characterized by intense, dry, gusty Santa Ana winds. This weather event drove a series of destructive wildfires that took a devastating toll on people, property, natural resources, and infrastructure. Although some fires burned into early November, the heaviest damage occurred during the first three days of the siege when the winds were the strongest.

During this siege, 17 people lost their lives, ten were killed by the fires outright, three were killed while evacuating, four died from other fire siege related causes, and 140 firefighters, and an unknown number of civilians were injured. A total of 3,069 homes and other buildings were destroyed, and hundreds more were damaged. Hundreds of thousands of people were evacuated at the height of the siege. The fires burned over half a million acres, including

populated areas, wildlife habitat and watershed. Portions of the electrical power distribution network, telecommunications systems, and even some community water sources were destroyed. Transportation was disrupted over a large area for several days, including numerous road closures. Both the Governor of California and the President of the United States personally toured the ongoing fires. Governor Schwarzenegger proclaimed a state of emergency in seven counties before the end of the first day. President Bush quickly declared a major disaster. While the total impact of the 2007 fire siege was less than the disastrous fires of 2003, it was unquestionably one of the most devastating wildfire events in the history of California. (Source: http://www.fire.ca.gov/fire_protection/downloads/siege/2007/Overview_Introduction.pdf)

Wildfire Characteristics

There are three categories wildland/urban interface fire: The classic wildland/urban interface exists where well-defined urban and suburban development presses up against open expanses of wildland areas; the mixed wildland/urban interface is characterized by isolated homes, subdivisions, and small communities situated predominantly in wildland settings. The occluded wildland/urban interface exists where islands of wildland vegetation occur inside a largely urbanized area. Certain conditions must be present for significant interface fires to occur. The most common conditions include: hot, dry and windy weather; the inability of fire protection forces to contain or suppress the fire; the occurrence of multiple fires that overwhelm committed resources; and a large fuel load (dense vegetation). Once a fire has started, several conditions influence its behavior, including fuel topography, weather, drought, and development.

Southern California has two distinct areas of risk for wildland fire. The foothills and lower mountain areas are most often covered with scrub brush or chaparral. The higher elevations of mountains also have heavily forested terrain. The lower elevations covered with chaparral create one type of exposure.

“Past fire suppression is not to blame for causing large shrub land wildfires, nor has it proven effective in halting them.” said Dr. Jon Keeley, a USGS fire researcher who studies both southern California shrub lands and Sierra Nevada forests. “Under Santa Ana conditions, fires carry through all chaparral regardless of age class. Therefore, prescribed burning programs over large areas to remove old stands and maintain young growth as bands of firebreaks resistant to ignition are futile at stopping these wildfires.” (Source: http://www.usgs.gov/public/press/public_affairs/press_releases/pr1805m.html)

The higher elevations of Southern California’s mountains are typically heavily forested. The magnitude of the 2003 fires is the result of three primary factors: (1) severe drought, accompanied by a series of storms that produce thousands of lightning strikes and windy conditions; (2) an infestation of bark beetles that has killed thousands of mature trees; and (3) the effects of wildfire suppression over the past century that has led to buildup of brush and small diameter trees in the forests.

"When Lewis and Clark explored the Northwest, the forests were relatively open, with 20 to 25 mature trees per acre. Periodically, lightning would start fires that would clear out underbrush and small trees, renewing the forests. Today's forests are completely different, with as many as 400 trees crowded onto each acre, along with thick undergrowth. This density of growth makes forests susceptible to disease, drought and severe wildfires. Instead of restoring forests, these wildfires destroy them and it can take decades to recover. This radical change in our forests is the result of nearly a century of well-intentioned but misguided management." (Source: Overgrown Forests Require Preventive Measures, By Gale A. Norton (Secretary of the Interior), USA Today Editorial, August 21, 2002)

The Interface

One challenge Southern California faces regarding the wildfire hazard is from the increasing number of houses being built on the urban/wildland interface. Every year the growing population expands further into the hills and mountains, including forest lands. The increased "interface" between urban/suburban areas, and the open spaces created by this expansion, produces a significant increase in threats to life and property from fires, and pushes existing fire protection systems beyond original or current design and capability. Property owners in the interface are not aware of the problems and fire hazards or risks on their own property. Furthermore, human activities increase the incidence of fire ignition and potential damage.

Fuel

Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is classified by volume and by type. Volume is described in terms of "fuel loading," or the amount of available vegetative fuel.

The type of fuel also influences wildfire. Chaparral is a primary fuel of Southern California wildfires. Chaparral habitat ranges in elevation from near sea level to over 5,000' in Southern California. Chaparral communities experience long dry summers and receive most of their annual precipitation from winter rains. Although chaparral is often considered as a single species, there are two distinct types; hard chaparral and soft chaparral. Within these two types are dozens of different plants, each with its own particular characteristics.

The northern boundary of Whittier is composed of chaparral land, especially in the foothills.

An important element in understanding the danger of wildfire is the availability of diverse fuels in the landscape, such as natural vegetation, manmade structures and combustible materials. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread. After decades of fire suppression "dog-hair" thickets have accumulated, which enable high intensity fires to flare and spread rapidly.

Topography

Topography influences the movement of air, thereby directing a fire course. For example, if the percentage of uphill slope doubles, the rate of spread in wildfire will likely double. Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Solar heating of dry, south-facing slopes produces up slope drafts that can complicate fire behavior. Unfortunately, hillsides with hazardous topographic characteristics are

also desirable residential areas in many communities. This underscores the need for wildfire hazard mitigation and increased education and outreach to homeowners living in interface areas.

Weather

Weather patterns combined with certain geographic locations can create a favorable climate for wildfire activity. Areas where annual precipitation is less than 30 inches per year are extremely fire susceptible. High-risk areas in Southern California share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. The so-called "Santa Ana" winds, which are heated by compression as they flow down to Southern California from Utah, create a particularly high risk, as they can rapidly spread what might otherwise be a small fire.

Drought

Recent concerns about the effects of climate change, particularly drought, are contributing to concerns about wildfire vulnerability. The term 'drought' is applied to a period in which an unusual scarcity of rain causes a serious hydrological imbalance. Unusually dry winters, or significantly less rainfall than normal, can lead to relatively drier conditions and leave reservoirs and water tables lower. Drought leads to problems with irrigation and contributes to additional fires, or increased difficulty in fighting fires.

Development

Growth and development in scrubland and forested areas is increasing the number of human-caused structures in Southern California interface areas. Wildfire affects development, yet development can also influence wildfire. Owners often prefer homes that are private with scenic views, nestled in vegetation, and use natural materials. A private setting is usually far from public roads, or hidden behind a narrow, curving driveway. These conditions, however, make evacuation and firefighting difficult. The scenic views found along mountain ridges can also mean areas of dangerous topography. Natural vegetation contributes to scenic beauty, but it may also provide a ready trail of fuel leading a fire directly to the combustible fuels of the home itself.

Wildfire Hazard Assessment

Hazard Identification

Extreme weather conditions such as high temperature, low humidity, and/or winds of extraordinary force causes an ordinary fire to expand into one of massive proportions.

Wildfire hazard areas are commonly identified in regions of the wildland/urban interface. Ranges of the wildfire hazard are further determined by the ease of fire ignition due to natural or human conditions and the difficulty of fire suppression. The wildfire hazard is also magnified by several factors related to fire suppression/control such as the surrounding fuel load, weather, topography, and property characteristics.

Generally, hazard identification rating systems are based on weighted factors of fuels, weather and topography. In order to determine the "base hazard factor" of specific wildfire hazard sites

and interface regions, several factors must be taken into account. Categories used to assess the base hazard factor include:

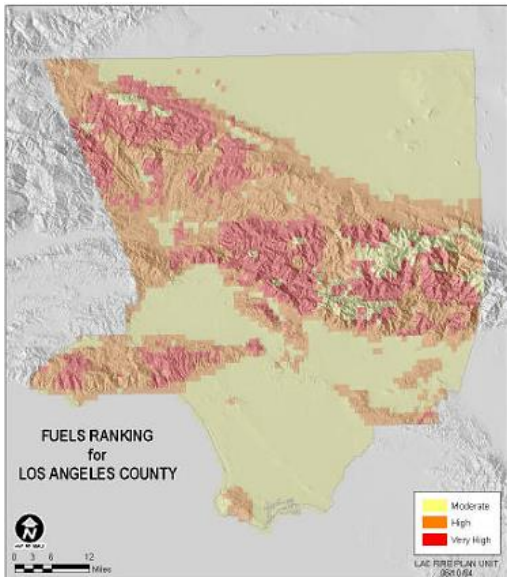
- ✓ Topographic location, characteristics and fuels
- ✓ Site/building construction and design
- ✓ Site/region fuel profile (landscaping)
- ✓ Defensible space
- ✓ Accessibility
- ✓ Fire protection response
- ✓ Water availability

Vulnerability Assessment

The use of Geographic Information System (GIS) technology in recent years is a great asset to fire hazard assessment, allowing further integration of fuels, weather and topography data for such ends as fire behavior prediction, watershed evaluation, mitigation strategies and hazard mapping.

Large facilities (particularly schools and other facilities with vulnerable populations) located near the Wildland/Urban Interface must incorporate adequate evacuation planning into their Site Emergency Plans. Fire drills and fire evacuation routes should be pre-planned and practiced with transportation vehicles and shelter locations pre-planned.

Map: Los Angeles County Fire Hazard Map
(Source: County of Los Angeles All-Hazards Mitigation Plan)



Risk Analysis

Southern California residents are served by a variety of local fire departments as well as county, state and federal fire resources. Data that includes the location of interface areas in the county can be used to assess the population and total value of property at risk from wildfire and direct these fire agencies in fire prevention and response.

Key factors included in assessing wildfire risk include ignition sources, building materials and design, structural density, slope, vegetative fuel, fire occurrence and weather, as well as occurrences of drought.

The National Wildland/Urban Fire Protection Program has developed the Wildland/Urban Fire Hazard Assessment Methodology tool for communities to assess their risk to wildfire. For more information on wildfire hazard assessment refer to http://www.Firewise.org.

Fire hazards of concern in the City of Whittier are those associated with structures and brush, as well as earthquake induced fires. Fire potential is typically greatest in the months of August, September, and October, when dry vegetation, combined with offshore dry Santa Ana winds, create a high potential for spontaneous fires. The hillsides and steep slopes facilitate rapid fire spread.

Local Conditions

Fire hazards threaten lives, property, and natural resources, and impact vegetation and wildlife habitats.

Weather

Weather conditions have many complex and important effects on fire intensity and behavior. Wind is of prime importance; as wind increases in velocity, the rate of fire spread also increases. Relative humidity (i.e., relative dryness of the air) also has a direct effect, the drier the air, and the drier the vegetation; the more likely the vegetation will ignite and burn. Precipitation (annual total, seasonal distribution and storm intensity) further affects the moisture content of dead and living vegetation, which influences fire ignition and behavior.

In addition to winds, structural development within or adjacent to wildland exposures represents an extreme fire protection problem due to flying embers and the predominance of combustible roof coverings.

Topography

Topography affects wildland fire behavior, and the ability of firefighters and their equipment to take action to suppress those fires. One example is a fire starting in the bottom of a canyon may expand quickly to the ridge top before initial attack forces can arrive. Rough topography greatly limits road construction, road standards, and accessibility by ground equipment. Steep topography also channels airflow, creating extremely erratic winds on lee slopes and in canyons. Water supply for fire protection to structures at higher elevations is frequently dependent on pumping units. The source of power for such units is usually from overhead distribution lines, which are subject to destruction by wildland fires.

Vegetation

A key to effective fire control and the successful accommodation of fire in wildland management is the understanding of fire and its environment. Fire environment is the complex of fuel, topographic, and air mass factors, that influence the inception, growth, and behavior of a fire. The topography and weather components are, for all practical purposes, beyond man's control, but it is a different story with fuels, which can be controlled before the outbreak of fires. In terms of future urban expansion, finding new ways to control and understand these fuels can lead to possible fire reduction.

Of these different vegetation types, coastal sage scrub, chaparral, and grasslands reach some degree of flammability during the dry summer months and, under certain conditions, during the winter months. For example, as chaparral gets older, twigs and branches within the plants die and are held in place. A stand of brush 10- to 20-years of age usually has enough dead material to produce rates of spread about the same as in grass fires when the fuels have dried out. In severe drought years, additional plant material may die, contributing to the fuel load. There will normally be enough dead fuel accumulated in 20- to 30-year old brush to give rates of spread about twice as fast as in a grass fire. Under moderate weather conditions that produce a spread rate of one-half foot per second in grass, a 20- to 30-year old stand of chaparral may have a rate of fire spread of about one foot per second. Fire spread in old brush (40 years or older) has been measured at eight times as fast as in grass, about four feet per second. Under extreme weather conditions, the fastest fire spread in grass is 12 feet per second or about eight miles per hour.

Community Wildfire Issues

What is Susceptible to Wildfires?

Los Angeles County Fire Department provides fire protection services to the City of Whittier. Map: City of Whittier Fire Hazard Severity Zones.

Defensible space can be created around structures by taking precautionary measures such as: Thinning trees and brush within a minimum of 30 feet of a home. Beyond 30 feet, remove dead wood, debris and low tree branches. Keeping lawns trimmed, leaves raked, and the roof and rain-gutters free from debris such as dead limbs and leaves. Stacking firewood at least 30 feet away from a home. Storing flammable materials, liquids and solvents in metal containers outside the home at least 30 feet away from structures and wooden fences.

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In Whittier, this scenario highlights the need for fire mitigation activity in all sectors of the region, wildland/urban interface or not. Examples of actions homeowners can take to mitigate fires include:

- ✓ Define a defensible space of a 30-foot non-combustible buffer area around the house
- ✓ Reduce flammable vegetation, trees and brush around the house
- ✓ Remove or prune trees
- ✓ Cut grass and weeds regularly

- ✓ Relocate wood piles and leftover materials
- ✓ Keep it clean
- ✓ Install fire resistant roofing materials and spark arrestors on chimneys

Fire Hazard Severity Zone (FHSZ) Mapping*

Public Resources Code (PRC) 4201-4204 and Government Code 51175-89 direct the California Department of Forestry and Fire Protection (CAL FIRE) to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred to as Fire Hazard Severity Zones (FHSZs), define the application of various mitigation strategies to reduce risk associated with wildland fires. State Responsibility Areas (SRAs) were originally mapped in 1985 and last updated in 2007.

CAL FIRE has remapped both state and local fire responsibility areas to provide updated map zones, based on new data, science, and technology that will create more accurate zone designations such that mitigation strategies are implemented in areas where hazards warrant these investments. The zones will provide specific designation for application of defensible space and building standards consistent with known mechanisms of wildfire impacts on people, property, and natural resources. Wildland-urban interface (WUI) building codes that have been adopted by the California Building Standards Commission took effect January 1, 2008 and use Fire Hazard Severity Zone (FHSZ) maps as the basis for applicability of certain code sections. FHSZ maps will follow established adoption processes required by state statute.
http://osfm.fire.ca.gov/strucfireengineer/pdf/bml/wuiproducts.pdf

Local Responsibility Areas (LRA) were originally mapped in 1996 and are currently undergoing the local adoption process for those changes. CAL FIRE has made recommendations for Very High Fire Hazard Severity Zones for over 200 cities. The process was completed in 2011. CAL FIRE recommendations are available at:
http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_zones_maps_citylist.php.

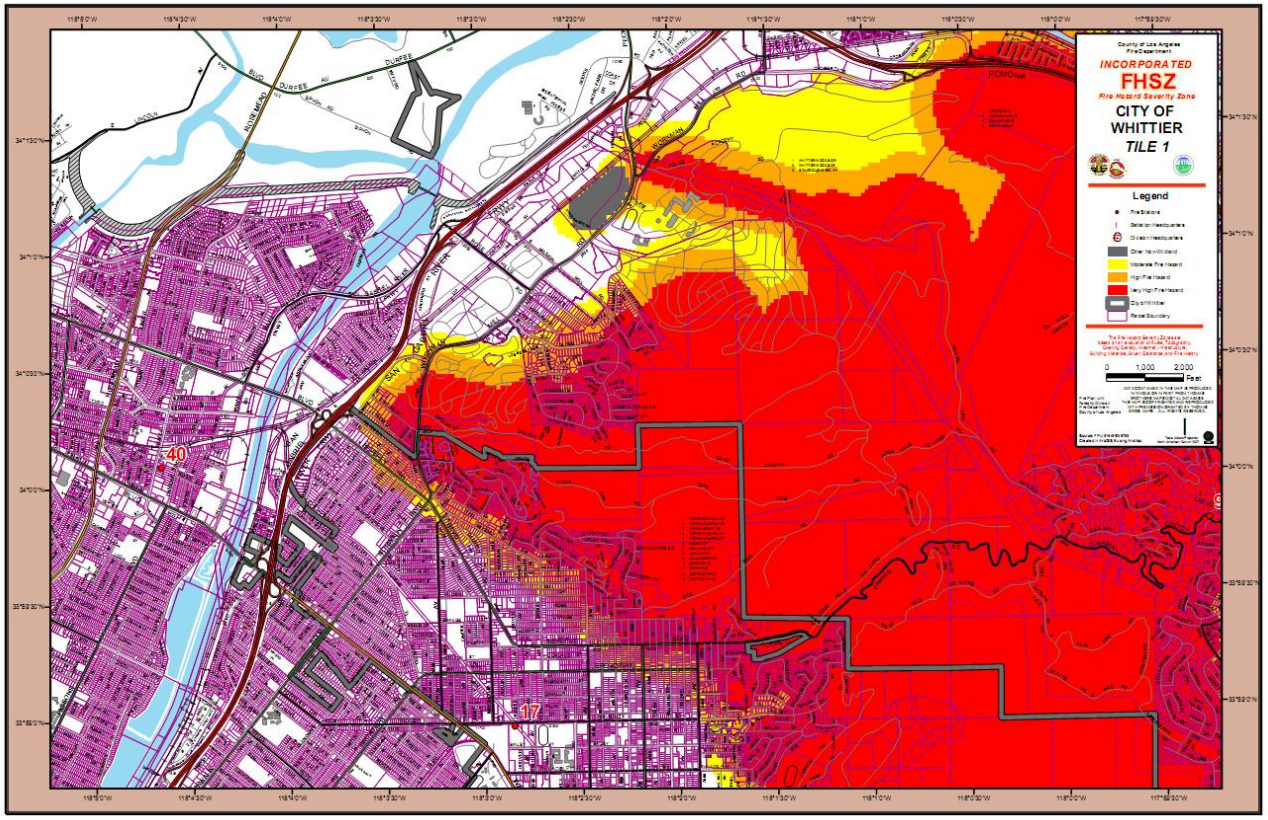
Many local governments have made similar designations under their own authority. Current FHSZ mapping is available for 2007 and 2008 for most LRA areas. LRA FHSZ maps must be ratified by the local government agency and the state for full adoption. There are still a few LRA maps pending local ratification prior to being fully adopted.

The following CAL FIRE produced FHSZ maps graphically depict the geographic distribution of threats associated with wildfire impacting the City of Whittier.

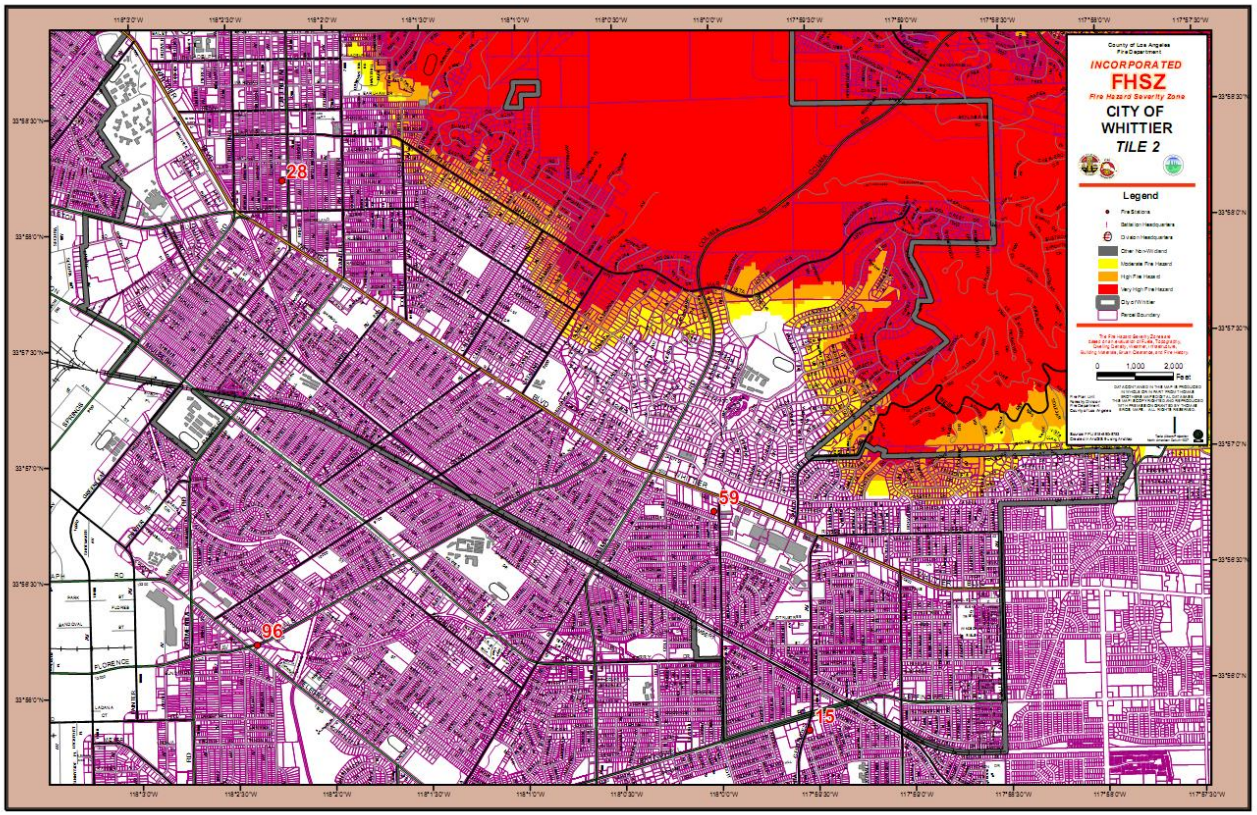
* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1**

B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))

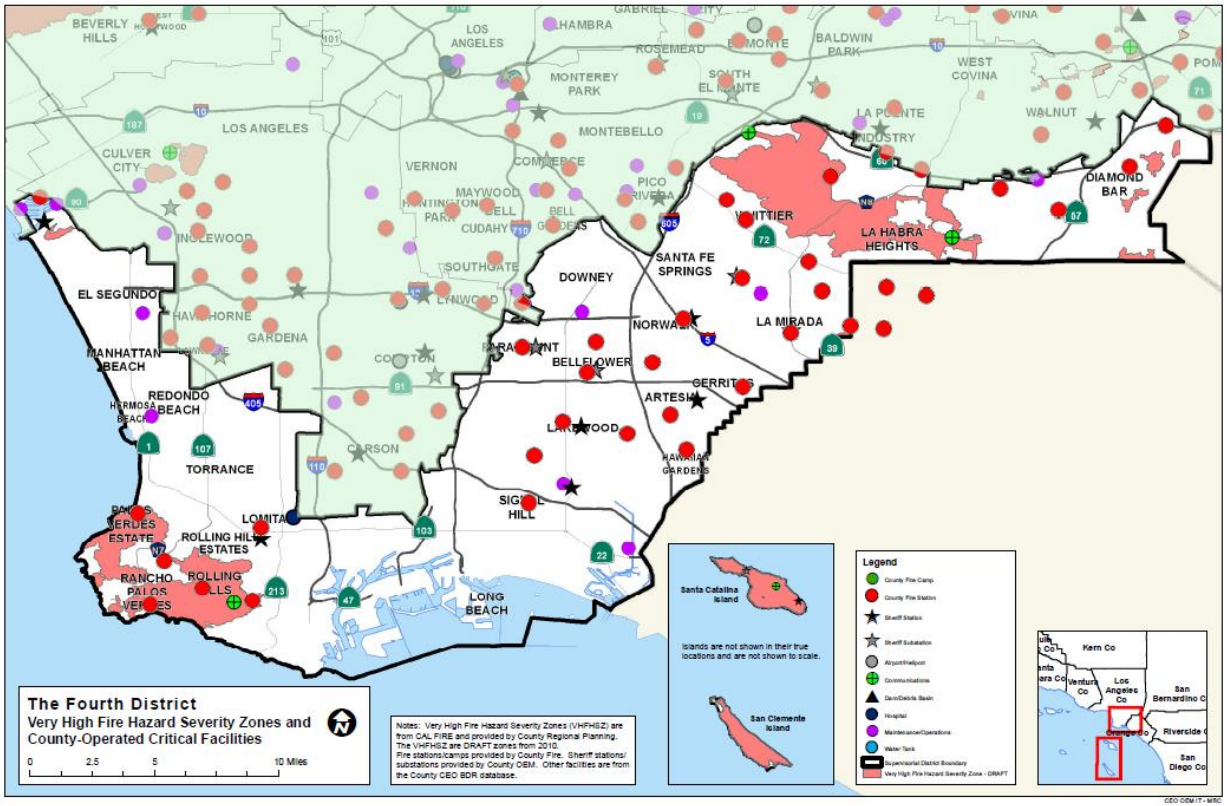
Map: City of Whittier Fire Hazard Severity Zones – Tile 1
(Source: ftp://frap.cdf.ca.gov/fhszlocalmaps/los_angeles/whittier.pdf)



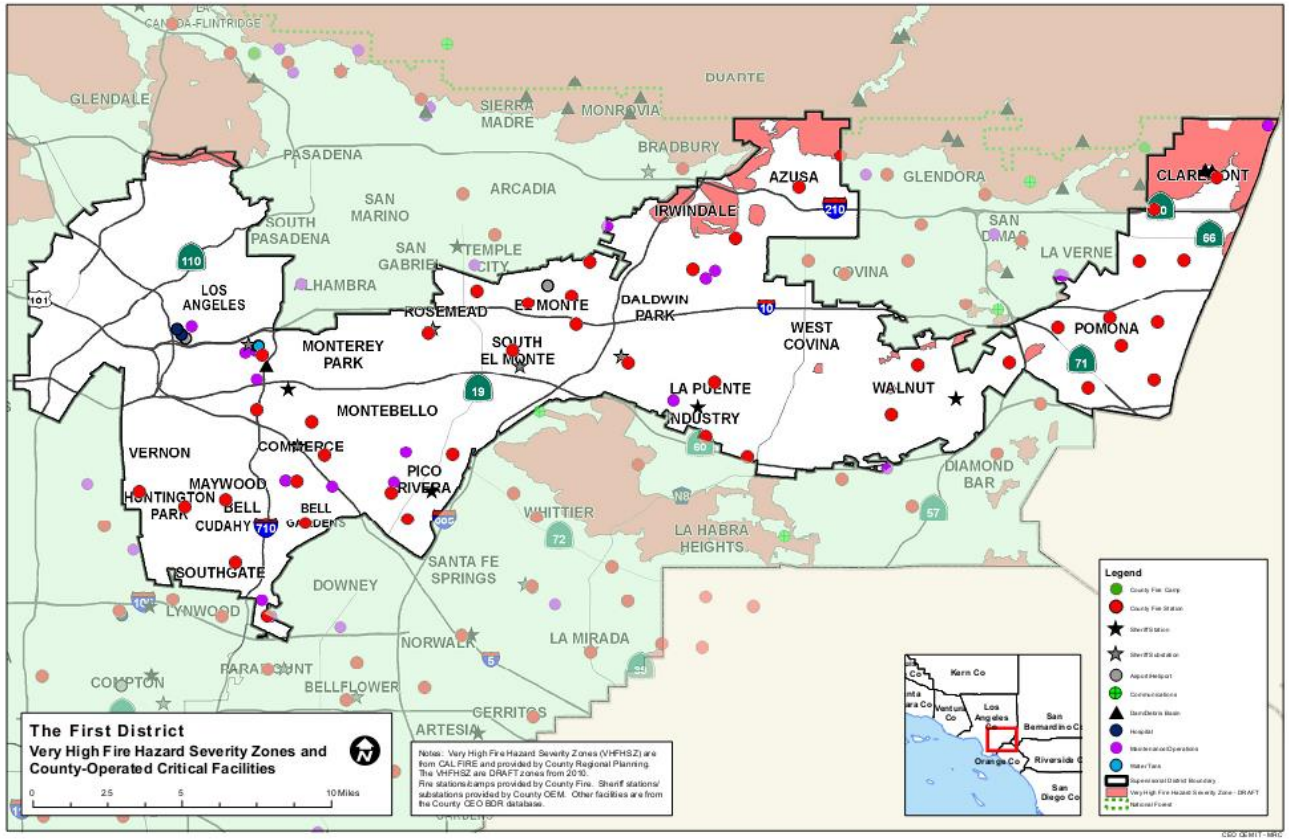
Map: City of Whittier Fire Hazard Severity Zones – Tile 2
(Source: ftp://frap.cdf.ca.gov/fhszlocalmaps/los_angeles/whittier.pdf)



Map: Very High Fire Hazard Severity Zones and Public Schools, District 4
(Source: County of Los Angeles Chief Executive Office - GIS)



Map: Very High Fire Hazard Severity Zones and County-Operated Critical Facilities, District 1
(Source: County of Los Angeles Chief Executive Office - GIS)



Impact of Wildfires in the City of Whittier*

Wildfires and their impact varies by location and severity of any given wildfire event, and will likely only affect certain areas of the county during specific times. Based on the risk assessment, it is evident that wildfires will have potentially devastating economic impact to certain areas of the City. Impact that is not quantified, but can be anticipated in future events, includes:

- ✓ Injury and loss of life
- ✓ Commercial and residential structural damage
- ✓ Disruption of and damage to public infrastructure
- ✓ Secondary health hazards e.g. mold and mildew
- ✓ Damage to roads/bridges resulting in loss of mobility
- ✓ Significant economic impact (jobs, sales, tax revenue) upon the community
- ✓ Negative impact on commercial and residential property values
- ✓ Significant disruption to students and teachers as temporary facilities and relocations would likely be needed

Severity

The primary effects of fire, such as loss of life, injury, destruction of buildings and wildlife, are generally well known. Fire also has a number of secondary effects, such as strained public utilities, depleted water supplies, downed power lines, disrupted telephone systems, and closed roads. In addition, flood control facilities are overtaxed by the increased flow from bare hillsides, and the resulting debris that washes down. Affected recreation areas may have to close or restrict operations. Moreover, buildings destroyed by fire are usually eligible for property tax reassessment, which reduces revenue to local government.

A fire is usually extinguished within a few days, but its effects last much longer. Grasslands re-sprout the following spring, a chaparral community regenerate in three to five years, and an oak woodland with most of its seedlings and saplings destroyed will start a new crop within five to ten years. Coniferous timber stands are most susceptible to long-term damage, taking as much as 50 to 100 years to reestablish a forest.

Fire destroys surface vegetation, leaving the soil bare and subject to erosion, when the rains begin in the fall and winter. Raindrops hit the surface with undiminished impact, splashing particles of soil loose that move downhill and are carried away by running water. Fire also destroys most of the roots that hold the soil in place, allowing running water to wash the soil away. Mudslides and mudflows can result from these processes.

* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3**

B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))

Growth and Development in the Interface

The hills and mountainous areas of Southern California are considered to be interface areas. The development of homes and other structures is encroaching onto the wildlands and is expanding the wildland/urban interface. The interface neighborhoods are characterized by a diverse mixture of varying housing structures, development patterns, ornamental and natural vegetation and natural fuels.

In the event of a wildfire, vegetation, structures and other flammables can merge into unwieldy and unpredictable events. Factors important to the fighting of such fires include access, firebreaks, proximity of water sources, distance from a fire station and available firefighting personnel and equipment. Reviewing past wildland/urban interface fires shows that many structures are destroyed or damaged for one or more of the following reasons:

- ✓ Combustible roofing material
- ✓ Wood construction
- ✓ Structures with no defensible space
- ✓ Fire department has poor access to structures
- ✓ Subdivisions located in heavy natural fuel types
- ✓ Structures located on steep slopes covered with flammable vegetation
- ✓ Limited water supply
- ✓ Winds over 30 miles per hour

Road Access

Road access is a major issue for all emergency service providers. As development encroaches into the rural areas of the county, the number of houses without adequate turn-around space is increasing. In many areas, there is not adequate space for emergency vehicle turnarounds in single-family residential neighborhoods, obstructing emergency workers because they cannot access houses. Fire trucks are large, and firefighters are challenged by narrow roads and limited access. When there is inadequate turn around space, the fire fighters can only work to remove the occupants, but cannot safely remain to save the threatened structures.

Water Supply

Fire fighters in remote and rural areas are faced by limited water supply and lack of hydrant taps. Rural areas are characteristically outfitted with small diameter pipe water systems, inadequate for providing sustained fire-fighting flows.

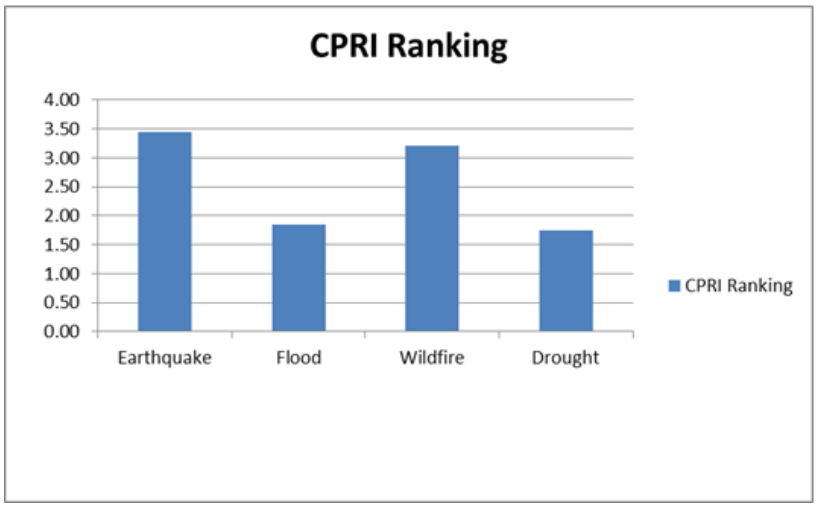
Interface Fire Education Programs and Enforcement

Fire protection in urban/wildland interface areas may rely heavily more on the landowner's personal initiative to take measures to protect his or her own property. Therefore, public education and awareness plays a greater role in interface areas. In those areas with strict fire codes, property owners who resist maintaining the minimum brush clearances can be cited for failure to clear brush.

The Need for Mitigation Programs

Continued development into the interface areas has growing impact on the wildland/urban interface. Periodically, the historical losses from wildfires in Southern California are catastrophic, with historical deadly and expensive fires. The continued growth and development increases the public need for mitigation planning in Southern California.

Section 7: Drought



Previous Occurrences of Drought in the City of Whittier*

Fortunately, there is no history of severe drought within the City of Whittier and the City has not been impacted by a drought since the last Plan update. However, since the writing of the 2010 Mitigation Plan and because of increased state and regional concern for the possibility of a long-term drought, the City is actively encouraging and enforcing conservation. Following is the resolution passed by the City Council on May 15, 2015:

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* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B2**

B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

Attachment: City Council Water Conservation Ordinance – May 15, 2015

City of Whittier
2015-16 Temporary Water Restrictions
due to
State-wide Emergency Drought Conditions

Whereas, the City of Whittier is an urban water supplier as defined in the California Water Code Section 10617 and the City provides water to a service area comprising approximately 65% of the City;

Whereas, the Governor of the State of California on January 17, 2014 issued a proclamation of a state of emergency under the California Emergency Services Act based on drought conditions, and on April 25, 2014 the Governor issued a proclamation of a continued state of emergency based on continued drought conditions;

Whereas, the California State Water Resources Control Board on July 15, 2014 adopted emergency regulations as California Code of Regulations, Title 23, Sections 863, 864, 865 for statewide urban water conservation;

Whereas, the California State Water Resources Control Board on March 17, 2015 adopted Resolution No. 2015-0013 which included the finding that the drought conditions that formed the basis of the Governor's emergency proclamations continue to exist and which adopted emergency regulations that extended and expanded requirements for water conservation and prohibition of certain water uses;

Whereas, the Governor of the State of California on April 1, 2015 issued Executive Order B-29-15 calling for a statewide 25% reduction in potable urban water usage through February 28, 2016;

Whereas, the California State Water Resources Control Board on May 5, 2015 adopted Revisions to the emergency regulations which implement certain provisions of Executive Order B-29-15 by modifying and expanding once again requirements for water conservation and prohibition of certain water uses;

Whereas, the City of Whittier has adopted City of Whittier Final 2010 Urban Water Management Plan (UWMP) which was updated on July 29, 2014 by the City Council's approval of Addendum No. 1, both UWMP and Addendum No. 1 having been prepared by Stetson Engineers, Inc. and both having been approved by the California Department of Water Resources;

Whereas, the UWMP contains a water shortage contingency analysis and provisions for reductions of water use during a water shortage; and

Whereas, Whittier Municipal Code Section 13.24.010, "Restrictions During Emergency", reads:

> "Upon notice published in a daily paper in the city, the director of public works shall have the right to restrict the use of water for sprinkling, wetting, irrigation or construction purposes to such hours and for such time as may be deemed advisable. In the event of any emergency, the director of public works shall have the right, power and authority to turn off the water from any main or mains or pipes of the water system of the city with or without notice. The director of public works is enforced with power or authority to determine when an emergency exists and such discrimination shall be final or until revised at a meeting of the council. In addition to the power given in this section, the council reserves the right in the event of any emergency to turn off the water from any main or mains or pipes of the city either with or without notice and so long a time as the council may deem advisable."

NOW, THEREFORE, I, DAVID A. PELSER, DIRECTOR OF PUBLIC WORKS FOR THE CITY OF WHITTIER DETERMINE THAT:

1. Whittier Municipal Code Section 13.24.010 has empowered the Director of Public Works to determine when an emergency exists and to restrict the use of water for sprinkling, wetting, irrigation or construction purposes;
2. a water emergency exists as evidenced by the Governor's emergency proclamations and Executive Order noted above, and the State Water Resources Control Board emergency regulations apply to the City of Whittier urban water service area and require certain water use restrictions.

BASED ON THE AFOREMENTIONED DETERMINATION:

A. Certain uses of water are hereby prohibited as follows, except where necessary to address an immediate health and safety need or to comply with a term or condition in a permit issued by a state or federal agency:

   1. The application of potable water to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures;
   2. The use of a hose that dispenses potable water to wash a motor vehicle, except where the hose is fitted with a shut-off nozzle or device attached to it that causes it to cease dispensing water immediately when not in use;

3. The application of potable water to driveways and sidewalks;
4. The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system;
5. The application of potable water to outdoor landscapes during and within 48 hours after measurable rainfall;
6. The serving of drinking water other than upon request in eating or drinking establishments, including but not limited to restaurants, hotels, cafes, cafeterias, bars, or other public places where food or drink are served and/or purchased;
7. The irrigation with potable water of ornamental turf on public street medians; and
8. The irrigation with potable water of landscapes outside of newly constructed homes and buildings in a manner inconsistent with regulations or other requirements established by the California Building Standards Commission and the Department of Housing and Community Development.

B. To promote water conservation, operators of hotels and motels shall provide guests with the option of choosing not to have towels and linens laundered daily. The hotel or motel shall prominently display notice of this option in each guestroom using clear and easily understood language.

C. Outdoor irrigation of ornamental landscapes or turf with potable water by the persons it serves is limited to no more than three days per week. Customers with street addresses ending in an even number are restricted to outdoor irrigation on Mondays, Wednesdays and Saturdays; addresses ending in an odd number are restricted to outdoor irrigation on Tuesdays, Thursdays and Sundays. No outdoor irrigation is allowed on Fridays. Governmental organizations irrigating parks are restricted to irrigating three days per week but may select the specific three days.

These temporary water restrictions due to emergency drought conditions shall remain in effect as long as the State Water Resources Control Board emergency regulations shall remain in effect, or until the Director of Public Works determines that the emergency no longer exists, or until the City Council of the City of Whittier takes action to revise these restrictions.

EXECUTED THIS 15th DAY OF MAY, 2015, AT WHITTIER, CALIFORNIA.

David A. Pelser, PE, BCEE
Director of Public Works

Definition

Drought is defined as a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration) in a particular area, a condition often perceived as "normal". It is also related to the timing (e.g., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness of the rains (e.g., rainfall intensity, number of rainfall events). Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity. Drought should not be viewed as merely a physical phenomenon or natural event. Its impacts on society result from the interplay between a natural event (less precipitation than expected resulting from natural climatic variability) and the demand people place on water supply. Human beings often exacerbate the impact of drought. Recent droughts in both developing and developed countries and the resulting economic and environmental impacts and personal hardships have underscored the vulnerability of all societies to this "natural" hazard.

One dry year does not normally constitute a drought in California, but serves as a reminder of the need to plan for droughts. California's extensive system of water supply infrastructure - its reservoirs, groundwater basins, and inter-regional conveyance facilities - mitigates the effect of short-term dry periods for most water users. Defining when a drought begins is a function of drought impacts to water users. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere, or for water users having a different water supply. Individual water suppliers may use criteria such as rainfall/runoff, amount of water in storage, or expected supply from a water wholesaler to define their water supply conditions.

Many governmental utilities, the National Oceanic and Atmospheric Administration (NOAA), and the California Department of Water Resources, as well as academic institutions such as the University of Nebraska-Lincoln's National Drought Mitigation Center and the National Drought Mitigation Center, generally agree that there is no clear definition of drought. Drought is highly variable depending on location.

Drought Threat

The region's Mediterranean climate makes it especially susceptible to variations in rainfall. Though the potential risk to Whittier is in no way unique, severe water shortages could have a bearing on the economic well-being of the community. Comparison of climate (rainfall) records from Los Angeles with water well records beginning in 1930 from the San Gabriel Valley indicates the existence of wet and dry cycles on a 10-year scale as well as for much longer periods. The climate record for the Los Angeles region beginning in 1890 suggests drying conditions over the last century. With respect to the present day, climate data also suggests that the last significant wet period was the 1940s. Well level data and other sources seem to indicate the historic high groundwater levels (reflecting recharge from rainfall) occurred in the same decade. Since that time, rainfall (and groundwater level trends) appears to be in decline. This slight declining trend, however, is not believed to be significant. Climatologists compiled rainfall data from 96 stations in the State that spanned a 100-year period between 1890 and 1990. An interesting note is that during the first 50 years of the reporting period, there was only

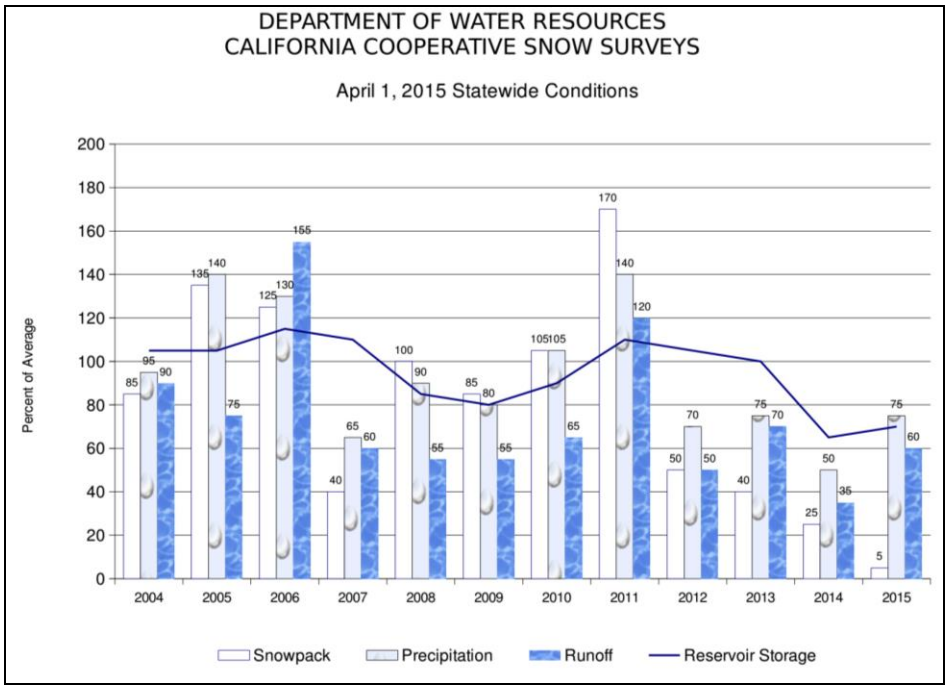
one year (1890) that had more than 35 inches of rainfall, whereas the second 50 year period recording of 5 year intervals (1941, 1958, 1978, 1982, and 1983) that exceeded 35 inches of rainfall in a single year. The year of maximum rainfall was 1890 when the average annual rainfall was 43.11 inches. The second wettest year on record occurred in 1983 when the State's average was 42.75 inches.

The driest year of the 100-year reported in the study was 1924 when the State's average rainfall was only 10.50 inches. The region with the most stations reporting the driest year in 1924 was the San Francisco Bay area. The second driest year was 1977 when the average was 11.57 inches. The most recent major drought (1987 to 1990) occurred at the end of a sequence of very wet years (1978 to 1983). The debate continues whether "global warming" is occurring, and the degree to which global climate change will have an effect on local micro-climates. The semi-arid southwest is particularly susceptible to variations in rainfall. A study that documented annual precipitation for California since 1600 from reconstructed tree ring data indicates that there was a prolonged dry spell from about 1755 to 1820 in California. Fluctuations in precipitation could contribute indirectly to a number of hazards including wildfire and the availability of water supplies.

General Situation

Figure: Water Supply Conditions below illustrates several indicators commonly used to evaluate California water conditions. The percent of average values are determined for measurement sites and reservoirs in each of the State's ten major hydrologic regions. Snow pack is an important indicator of runoff from Sierra Nevada watersheds, the source of much of California's developed water supply.

Figure: Water Supply Conditions
(Source: California Department of Water Resources)



Drought is a gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multiyear period. There is no universal definition of when a drought begins or ends.

Impact of Drought in the City of Whittier*

Impacts of drought are typically felt first by those most reliant on annual rainfall: ranchers engaged in dry land grazing, rural residents relying on wells in low-yield rock formations, or small water systems lacking a reliable source. Criteria used to identify statewide drought conditions do not address these localized impacts. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline.

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* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B3**

B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))

Types of Drought

There are four different ways that drought can be defined:
(1) Meteorological - a measure of departure of precipitation from normal. Due to climatic differences what is considered a drought in one location may not be a drought in another location.
(2) Agricultural - refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop.
(3) Hydrological - occurs when surface and subsurface water supplies are below normal.
(4) Socioeconomic - refers to the situation that occurs when physical water shortage begins to affect people.

Historical California Droughts

A significant drought, reported by many of the ranchers in southern California, occurred in 1860. The great drought of the 1930s, coined the "Dust Bowl," was geographically centered in the Great Plains yet ultimately affected water shortages in California. The drought conditions in the plains resulted in a large influx of people to the west coast. Approximately 350,000 people from Arkansas and Oklahoma immigrated mainly to the Great Valley of California. As more people moved into California, including Los Angeles County increases in intensive agriculture led to overuse of the Santa Ana River watershed and groundwater resulting in regional water shortages. Several bills have been introduced into Congress in an effort to mitigate the effects of drought. In 1998, President Clinton signed into law the National Drought Policy Act, which called for the development of a national drought policy or framework that integrates actions and responsibilities among all levels of government. In addition, it established the National Drought Policy Commission to provide advice and recommendations on the creation of an integrated federal policy. The most recent bill introduced into Congress was the National Drought Preparedness Act of 2003, which established a comprehensive national drought policy and statutorily authorized a lead federal utility for drought assistance. Currently there exists only an ad-hoc response approach to drought unlike other disasters (e.g., hurricanes, floods, and tornadoes) which are under the purview of FEMA.

Droughts exceeding three years are relatively rare in Northern California, the source of much of the State's developed water supply. The 1929-34 droughts established the criteria commonly used in designing storage capacity and yield of large Northern California reservoirs. The driest single year of California's measured hydrologic record was 1977. According to USGS, California's most recent multi-year droughts occurred between 1987-1992, 2006-2010 and 2012-2016.

The Long-term Climatic Viewpoint

The historical record of California hydrology is brief in comparison to geologically modern climatic conditions. The following sampling of changes in climatic conditions over time helps put California's twentieth century droughts into perspective. Most of the dates shown below are necessarily approximations.

Not only must the climatic conditions be inferred from indirect evidence, but the onset or extent of changed conditions may vary with geographic location. Readers interested in the subject of paleo-climatology are encouraged to seek out the extensive body of popular and scientific literature on this subject.

Past California Droughts

The historical record of California hydrology is brief in comparison to the time period of geologically modern climatic conditions. The following samplings of changes in climatic and hydrologic conditions help put California's twentieth century droughts into perspective, by illustrating the variability of possible conditions. Most of the dates shown below are approximations, since the dates must be inferred from indirect sources.

11,000 years before present

Beginning of Holocene Epoch- Recent time, the time since the end of the last major glacial epoch.

6,000 years before present

Approximate time when trees were growing in areas now submerged by Lake Tahoe. Lake levels were lower then, suggesting a drier climate.

900-1300 A.D. (Approximate)

The Medieval Warm Period, a time of warmer global average temperatures. The Arctic ice pack receded, allowing Norse settlement of Greenland and Iceland. The Anasazi civilization in the Southwest flourished, its irrigation systems supported by monsoonal rains.

1300-1800 A.D. (approximate)

The Little Ice Age, a time of colder average temperatures. Norse colonies in Greenland failed near the start of the time period, as conditions became too cold to support agriculture and livestock grazing. The Anasazi culture began to decline about 1300 and had vanished by 1600, attributed in part to drought conditions that made agriculture infeasible.

Mid - 1500s A.D.

Severe, sustained drought throughout much of the continental U.S., according to dendrochronology. Drought suggested as a contributing factor in the failure of European colonies at Parris Island, South Carolina and Roanoke Island, North Carolina.

1850s A.D.

Sporadic measurements of California precipitation began.

1890s A.D.

Long-term stream flow measurements began at a few California locations.

Of the many varied indexes used to measure drought, the "Palmer Drought Severity Index" (PDSI) is the most commonly used drought index in the United States*****. Developed by meteorologist Wayne Palmer, the PDSI is used to measure dryness based on recent temperature compared to the amount of precipitation. It utilizes a number range, 0 as normal, drought shown in terms of minus numbers, and wetness shown in positive numbers. The PDSI is most effective at analyzing long-range drought forecasts or predications. Thus, the PDSI is

* **ELEMENT B: HAZARD IDENTIFICATION AND RISK ASSESSMENT | B1**

B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))

very effective at evaluation trends in the severity and frequency of prolonged periods of drought, and conversely wet weather. The National Oceanic and Atmospheric Administration (NOAA) publish weekly Palmer maps, which are also used by other scientists to analyze the long-term trends associated with global warming and how this has affected drought conditions.

The University of Nebraska-Lincoln has published many of these Palmer Drought Index maps analyzing trends over the past one hundred years (National Drought Mitigation Center 2005; Figure I). In coastal southern California, from 1895 to 1995, severe droughts occurred ten to 15 percent of the time. From 1990 to 1995, severe droughts occurred ten to 20 percent of the time and as recently as 1989, a severe drought was documented that lasted for six years. More recently, between 1999 and 2004, a six-year drought on the Colorado River basin has resulted in a drawdown of Colorado River water storage by more than 50 percent. Based on these trends, severe droughts can readily occur in southern California. According to the California Natural Resources Conservation Service (NRCS), the current drought in southern California has caused extensive devastation to forests in the mountains of San Bernardino, San Jacinto and Palomar Mountains. Drought weakens trees which make them susceptible to infestation by bark-beetles. In turn dry vegetation and beetle infested trees are more susceptible to fire than healthy forests.

Map: U.S. Seasonal Drought Outlook is the most current snapshot of drought conditions across the U.S. It is provided by NOAA's Climate Prediction Center.

Map: U.S. Seasonal Drought Outlook
(Source: NOAA Climate Prediction Center)

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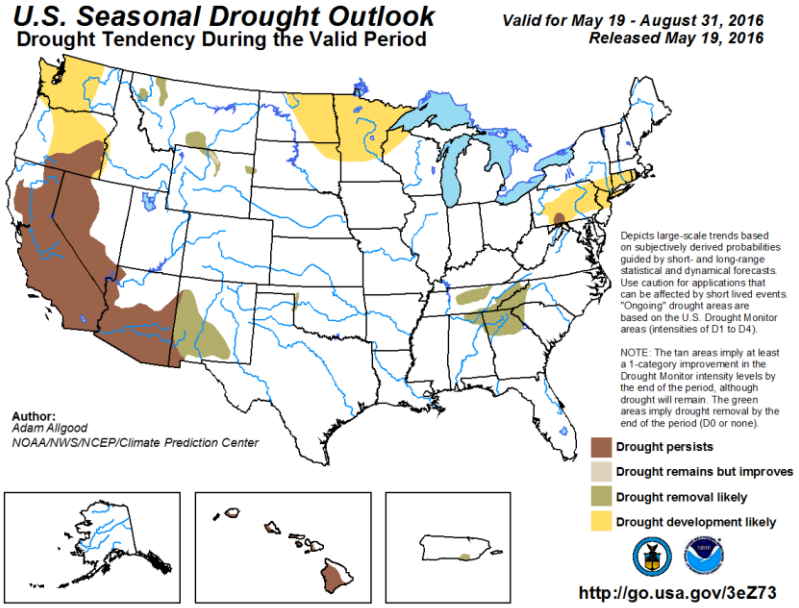

PART III: MITIGATION STRATEGIES

Section 8: Mitigation Strategies

Overview of Mitigation Strategy

As the cost of damage from natural disasters continues to increase nationwide, the City of Whittier recognizes the importance of identifying effective ways to reduce vulnerability to disasters. Mitigation Plans assist communities in reducing risk from natural hazards by identifying resources, information and strategies for risk reduction, while helping to guide and coordinate mitigation activities throughout the City.

The plan provides a set of action items to reduce risk from natural hazards through education and outreach programs, and to foster the development of partnerships. Further, the plan provides for the implementation of preventative activities, including programs that restrict and control development in areas subject to damage from natural hazards.

The resources and information within the Mitigation Plan:

1. Establish a basis for coordination and collaboration among agencies and the public in the City of Whittier;
2. Identify and prioritize future mitigation projects; and
3. Assist in meeting the requirements of federal assistance programs

The Mitigation Plan is integrated with other City plans including the City's Emergency Operations Plan, the General Plan (including the Background Report, Housing Element, and associated Environmental Impact Report), the Capital Improvement Plan, and department-specific standard operating procedures.

Planning Approach

The four-step planning approach outlined in the FEMA publication, *Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies* (FEMA 386-3) was used to develop this plan:

- ✓ **Develop mitigation goals and objectives -** The risk assessment (hazard characteristics, inventory, and findings), along with municipal policy documents, were utilized to develop mitigation goals and objectives.
- ✓ **Identify and prioritize mitigation actions -** Based on the risk assessment, goals and objectives, existing literature/resources, and input from participating entities, mitigation activities were identified for each hazard. Activities were 1) qualitatively evaluated against the goals and objectives, and other criteria; 2) identified as high, medium, or low priority; and 3) presented in a series of hazard-specific tables.
- ✓ **Prepare implementation strategy -** Generally, high priority activities are recommended for implementation first.

However, based on community needs and goals, project costs, and available funding, some medium or low priority activities may be implemented before some high priority items.

- ✓ **Document mitigation planning process -** The mitigation planning process is documented throughout this plan.

Mitigation Measure Categories

Following is FEMA's list of mitigation categories. The activities identified by the Planning Team are consistent with the six broad categories of mitigation actions outlined in FEMA publication 386-3 *Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies*.

- ✓ **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.
- ✓ **Property Protection:** Actions that involve modification of existing buildings or structures to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
- ✓ **Public Education and Awareness:** Actions to inform and educate citizens, property owners, and elected officials about hazards and potential ways to mitigate them.

  Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
- ✓ **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses preserve or restore the functions of natural systems. Examples include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- ✓ **Emergency Services:** Actions that protect people and property during and immediately following a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.
- ✓ **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, retaining walls, and safe rooms.

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Goals*

The 2005 Planning Team developed mitigation goals to avoid or reduce long-term vulnerabilities to hazards. These general principles clarify desired outcomes and have been maintained during the 2010 and 2016 updates.

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* **ELEMENT C. MITIGATION STRATEGY | C3**
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))

The goals are based on the risk assessment and Planning Team input, and represents a long-term vision for hazard reduction or enhanced mitigation capabilities. They are compatible with community needs and goals expressed in other planning documents prepared by the City.

Each goal is supported by mitigation action items. The Planning Team developed these action items through its knowledge of the local area, risk assessment, review of past efforts, identification of mitigation activities, and qualitative analysis.

The five mitigation goals and descriptions are listed below.

Protect Life and Property

FEMA defines **Goals** as general guidelines that explain what you want to achieve. They are usually broad policy-type statements, long-term, and represent global visions.

Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to losses from natural, human-caused, and technological hazards.

Improve hazard assessment information to make recommendations for avoiding new development in high hazard areas and encouraging preventative measures for existing development in areas vulnerable to natural, human-caused, and technological hazards.

Enhance Public Awareness

FEMA defines **Mitigation Activities** as specific actions that help you achieve your goals and objectives.

Develop and implement education and outreach programs to increase public awareness of the risks associated with natural, human-caused, and technological hazards.

Provide information on tools; partnership opportunities, and funding resources to assist in implementing mitigation activities.

Preserve Natural Systems

Support management and land use planning practices with hazard mitigation to protect life.

Preserve, rehabilitate, and enhance natural systems to serve hazard mitigation functions.

Encourage Partnerships and Implementation

Strengthen communication and coordinate participation with public agencies, citizens, non-profit organizations, business, and industry to support implementation.

Encourage leadership within the City and public organizations to prioritize and implement local and regional hazard mitigation activities.

Strengthen Emergency Services

Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.

Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.

Coordinate and integrate hazard mitigation activities where appropriate, with emergency operations plans and procedures.

The Planning Team also developed hazard-specific mitigation goals, which appear in Section 8: Mitigation Strategies.

Stakeholder Involvement*

The Mitigation Planning Team served as the primary stakeholders on the project. Additional stakeholders included outside agencies, the public, and decision makers.

The planning process on this project began in 2015 with the following departments represented on the Planning Team:

- Community Development Department
  - Planning Division
- Parks & Recreation Department
- Police Department
- Los Angeles County Fire Department
- Administration
- Public Works Department
  - Engineering
  - Building & Safety
- Controller's Office/Risk & Emergency Management

How are the Mitigation Action Items Organized?

The action items are a listing of activities in which City agencies and citizens can be engaged to reduce risk. Each action item includes an estimate of the timeline for implementation.

The action items are organized within the following Mitigation Actions Matrix, which lists all of the multi-hazard (actions that reduce risks for more than one specific hazard) and hazard-specific action items included in the mitigation plan. Data collection and research and the public participation process resulted in the development of these action items (Section 3: Planning Process). The Matrix includes the following information for each action item:

* **ELEMENT A: PLANNING PROCESS | A3**

A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))

Funding Source

The action items can be funded through a variety of sources, possibly including: operating budget/general fund, development fees, Community Development Block Grant (CDBG), Hazard Mitigation Grant Program (HMGP), other Grants, private funding, Capital Improvement Plan, and other funding opportunities.

Coordinating Organization

The Mitigation Actions Matrix assigns primary responsibility for each of the action items. The hierarchies of the assignments vary – some are positions, others departments, and other committees. The primary responsibility for implementing the action items falls to the entity shown as the "Coordinating Organization". The coordinating organization is the agency with regulatory responsibility to address hazards, or that is willing and able to organize resources, find appropriate funding, or oversee activity implementation, monitoring, and evaluation. Coordinating organizations may include local, county, or regional agencies that are capable of or responsible for implementing activities and programs.

Plan Goals Addressed

The plan goals addressed by each action item are included as a way to monitor and evaluate how well the mitigation plan is achieving its goals once implementation begins.

The plan goals are organized into the following five areas:

- ✓ Protect Life and Property
- ✓ Enhance Public Awareness
- ✓ Preserve Natural Systems
- ✓ Encourage Partnerships and Implementation
- ✓ Strengthen Emergency Services

*Ranking Priorities**

To assist with implementing the Hazard Mitigation Plan the Planning Team adopted the following process for ranking mitigation action items. Designations of "High", "Medium", and "Low" priority have been assigned to each action item using the following criteria:

Does the Action:

- solve the problem?
- address Vulnerability Assessment?
- reduce the exposure or vulnerability to the highest priority hazard?
- address multiple hazards?

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* **ELEMENT C. MITIGATION STRATEGY | C5**

C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

- benefits equal or exceed costs?
- implement a goal, policy, or project identified in the General Plan or Capital Improvement Plan?

Can the Action:
- be implemented with existing funds?
- be implemented by existing state or federal grant programs?
- be completed within the 5-year life cycle of the LHMP?
- be implemented with currently available technologies?

Will the Action:
- be accepted by the community?
- be supported by community leaders?
- adversely impact segments of the population or neighborhoods?
- require a change in local ordinances or zoning laws?
- positive or neutral impact on the environment?
- comply with all local, state and federal environmental laws and regulations?

Is there:
- sufficient staffing to undertake the project?
- existing authority to undertake the project?

During the prioritization meeting of the Task Force, department representatives were provided worksheets for each of their assigned action items. Answers to the criteria above determined the priority according to the following scale.

- 1-6 = Low priority
- 7-12 = Medium priority
- 13-18 = High priority

City of Whittier General Plan

The Planning Team went to great lengths to examine the various regulatory documents influencing the City's ability to mitigate against the identified hazards. Perhaps, the most important of those documents was the City's General Plan, last updated in 1993. It is the intention of the Planning Team to link the Mitigation Plan actions items as closely as possible to the City's General Plan. The purpose of this association is that many development projects require a determination of "General Plan conformity" prior to approval. If the Mitigation Plan and General Plan are aligned, this will better ensure both the sustainability and implementation of the Mitigation Plan. Since the establishment of the DMA 2000 regulations, FEMA and other regulators have been frustrated by the ineffectiveness of mitigation plan implementation – in other words, the failure of plans to actually affect the built environment and cause a reduction in risk. The Planning Team believes that changing the circle of build-damage-rebuild can most effectively be broken by linking the Mitigation Plan to the regulations and policy guidelines that allow for construction and land use.

The General Plan Policies are also included in the applicable Hazard-Specific Sections.

Following is a list of mitigation policies drawn from the General Plan.

Table: City of Whittier General Plan Goals & Policies

WHITTIER GENERAL PLAN GOALS & POLICIES (Note: Each of the policies includes a brief explanation as to applicability to the Hazard Mitigation Plan)	MITIGATION PLAN GOALS				
	Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
PUBLIC SAFETY ELEMENT					
Issue: Seismic Risk and Other Hazards Goal 2 Minimize loss of life, injuries, damage to property, and social and economic dislocation resulting from future regional or local seismic activity. Policy 2.1 Develop land use regulations that will mandate the review, evaluation, and restriction of development in areas where there are recognized hazards. Policy 2.2 Provide for the orderly abatement of structural hazards within the community, consistent with the degree of earthquake risk the community is willing to accept. Policy 2.3 Maintain contingency plans which will help Whittier citizens respond to and recover from an earthquake as quickly and effectively as possible.	X	X	X	X	X
Issue: Safety Services Goal 3 Maintain and enhance safety and emergency services in the City. Policy 3.1 Coordinate fire protection services with the County Fire Department. Policy 3.2 Maintain an adequate emergency response system. Policy 3.3 Assist the police and fire departments in monitoring the safety of all developments in the City. Policy 3.4 Continue to maintain fire safety through building inspections, weed abatement, and other programs. Policy 3.5 Provide adequate fire and police services for new developments in the planning area.	X	X	X	X	X

WHITTIER GENERAL PLAN GOALS & POLICIES (Note: Each of the policies includes a brief explanation as to applicability to the Hazard Mitigation Plan)	MITIGATION PLAN GOALS				
	Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services
Policy 3.6 Periodically review the City's emergency equipment and shelters to ensure that they are adequate to meet the needs of changing land uses and development types.					

Mitigation Actions Matrix*†‡§**

Following is Table: Mitigation Actions Matrix which identifies the existing and future mitigation activities developed by the Planning Team.

* **ELEMENT C. MITIGATION STRATEGY | C1**
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))
† **ELEMENT C. MITIGATION STRATEGY | C4**
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))
‡ **ELEMENT C. MITIGATION STRATEGY | C5**
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))
§ **ELEMENT D. MITIGATION STRATEGY | D2**
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))
** **ELEMENT D. MITIGATION STRATEGY | D3**
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))

Table: Mitigation Actions Matrix

Action Item Code	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed					Rank - Low, Med, High	Funding Source (u/k = unknown, CB = City Budget, GF = Grant Funded)	2016 Comments (Status - Completed, Revised, Deleted, New, and Deferred)	Planning/Policy Mechanism (HMP=Hazard Mitigation Plan, GP=General Plan, CIP=Capital Improvement Plan, CB=City Budget, GF=Grant Funded), UWMP=(Urban water Management Plan)
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
Multi-Hazard Mitigation Action Items												
MH 1	Reference the Natural Hazard Mitigation Plan in the next General Plan Safety Element update.	Community Development Department (CD)	5 years	X	X	X	X	X	High	u/k	Deferred – no General Plan update since the 2010 Mitigation Plan.	HMP
MH 2	Identify and pursue funding opportunities to develop and implement local mitigation activities.	Emergency Services Coordinator (ESC)	Ongoing	X	X	X	X	X	High	CB		CB
MH 3	Establish a formal role for the Hazard Mitigation Planning Team to develop a sustainable process for implementing, monitoring, and evaluating citywide mitigation activities.	Hazard Mitigation Planning Team (PT)	Completed		X		X		Low	CB	Revised – action item	HMP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	Hold bi-yearly meetings using EMS Community Disaster Preparedness Planning.											
MH 4	Maintain inventory of critical facilities (those facilities that provide life-saving services or support during the emergency response phase).	CD, Public Works (PW)	Ongoing	X			X	X	High	CB	Revised – initial inventory was completed during the 2012 update to the EOP. Inventory will be kept up-to-date using the EOP update process.	CB
MH 5	Develop, enhance, and implement education programs aimed at mitigating natural hazards, and reducing the risk to citizens, public agencies and private property	PT	Ongoing		X				High	CB		HMP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	owners.											
MH 6	Work with Los Angeles County Fire Department and Puente Hills Landfill Native Habitat Authority to coordinate mitigation activities for fire prevention utilizing the Fuel Modification Plan for implementation.	PT	Ongoing	X	X	X	X		High	CB		HMP
MH 7	Utilize the media to educate the public about hazards prevalent to their area. Especially interested in sharing availability of "My Hazards.com through Cal OES.	PT	1 year		X				High	CB	Revised – action item, timeline	HMP
MH 8	Publicize the documents associated with	PT	Ongoing		X				High	CB	Revised – action item	HMP

Action Item Code	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed					Rank - Low, Med, High	Funding Source (u/k = unknown, CB = City Budget, GF = Grant Funded)	2016 Comments (Status - Completed, Revised, Deleted, New, and Deferred)	Planning/Policy Mechanism (HMP=Hazard Mitigation Plan, GP=General Plan, CIP=Capital Improvement Plan, CB=City Budget, GF=Grant Funded), UWMP=(Urban water Management Plan)
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	emergency response and mitigation. Continue to post the Natural Hazards Mitigation Plan on the City's website.											
MH 9	Utilize the website to publicize FEMA's Emergency Management Institute's Independent Study Courses available to the public – particularly Disaster Mitigation for Homeowners. Also, LA County Fire's "Ready, Set, Go".	ESC	1 year		X				Med	n/k	Revised – action item	HMP
MH 10	Encourage and facilitate the adoption of California building codes and Los	CD	Ongoing	X		X	X	X	High	CB	Revised – action item	CB, HMP

Action Item Code	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed					Rank - Low, Med, High	Funding Source (u/k = unknown, CB = City Budget, GF = Grant Funded)	2016 Comments (Status - Completed, Revised, Deleted, New, and Deferred)	Planning/Policy Mechanism (HMP=Hazard Mitigation Plan, GP=General Plan, CIP=Capital Improvement Plan, CB=City Budget, GF=Grant Funded), UWMP=(Urban water Management Plan)
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	Angeles County Fire Code that provide protection for new construction and substantial renovations from the effects of identified hazards.											
MH 11	Review existing regulations to reduce the effect of natural hazards on future development (e.g. Zoning Code, General Plan).	CD	Ongoing	X					High	CB		HMP
MH 12	Assess availability of backup power resources (generators) of police, City Emergency Operations Center; upgrade resources as necessary.	PT	Completed					X			Completed in 2010	
MH 13	Promote hazard	PT	Ongoing		X				Med	CB	Revised – action	CB, HMP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	mitigation as a public value in recognition of its importance to the health, safety, and welfare of the population. (Example: Ready, Set, Go)										items	
MH 14	Coordinate and integrate natural hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	PT	Ongoing					X	Med	CB		CB, HMP
MH 15	Utilize existing public safety announcements on mitigation steps and strategies (e.g. residential earthquake retrofitting).	City Manager's Office (CM)	Ongoing	X	X				Low	CB	Completed – initial database established in 2011	CB, HMP
MH 16	Maintain land	ESC	Ongoing	X	X				Low	CB		CB, HMP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	management database in future hazard GIS system for properties in the City. This database would include information about location of areas threatened by earthquake faults, landslides, liquefaction, and wildfires)											
MH 17	Prioritize mitigation projects identified in the Capital Improvement Plan.	PW	Annual	X		X	X	X	High	CB		CIP
MH 18	Budget for and identifying staffing resources a year in advance of the 5-year Mitigation Plan update.	PT	Ongoing	X	X	X	X	X	High	u/k		CB
MH 19	Review, add, and enforce conditions of approval for all	CD, LACFD, PW	Ongoing	X					High	n/a	New	GP

Action Item Code	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed					Rank - Low, Med, High	Funding Source (u/k = unknown, CB = City Budget, GF = Grant Funded)	2016 Comments (Status - Completed, Revised, Deleted, New, and Deferred)	Planning/Policy Mechanism (HMP=Hazard Mitigation Plan, GP=General Plan, CIP=Capital Improvement Plan, CB=City Budget, GF=Grant Funded), UWMP=(Urban water Management Plan)
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	new construction and subdivision maps to minimize impacts/threats from fire, floods, and earthquakes.											
MH 20	Seek funding to update the General Plan Safety Element in conjunction with 5-year update to the next Mitigation Plan. As per California Senate Bill 379, Mitigation Plan updates after 2017 will be required to also include updates to the City's General Plan Safety Element.	CD	Now	X	X	X	X	X	High	CB, GF	New	CB, GF
Earthquake Mitigation Action Items												
EQ 1	Incorporate earthquake	LACFD	1 year					X	High	u/k	Revised – action item,	GP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	transportation evacuation routes into the Safety Element of the General Plan. Note: evacuation plan also used in wildfire evacuation depending on route availability										coordination organization, timeline	
EQ 2	Review seismic strength of remodeled structures in the City as deemed appropriate by the building official.	CD	Ongoing	X	X				High	CB		CB
EQ 3	Encourage reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and local government	ESC	Ongoing	X	X				High	CB	Revised – assignment	CB

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	offices.											
EQ 4	Adoption of California Building Code by municipality.	ESC	Completed	X							Completed – adopted in 2013	
EQ 5	Ensure post-disaster rebuilding is in conformance with applicable codes, specifications, and standards.	CD	Ongoing	X					High	CB	Revised – action item	CB
EQ 6	Ensure repairs or construction funded by Federal disaster assistance conform to applicable codes and standards.	CD	Ongoing	X					High	CB		
EQ 7	Encourage construction and subdivision design that can be applied to steep slopes to reduce the potential adverse impacts from ground failure,	CD	Ongoing	X					High	CB		

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	mudslides, etc.											
EQ 8	Encourage private property owners to conduct seismic strength evaluations of facilities classified as critical or essential to City emergency response activities.	CD, PW	Ongoing	X					High	GF	Revised –action item	HMP
Flood Mitigation Action Items												
FLD 1	Recommend revisions to proposed plans for development within floodplain, where appropriate.	CD	Ongoing	X					High	CB	Revised – action item	CB
FLD 2	Development on or adversely affecting floodplains shall be discouraged, if feasible alternatives exist, as determined by	CD	Ongoing	X					High	CB	Revised – action item	CB

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	the City.											
FLD 3	Analyze, identify and construct storm drainage facilities to mitigate flooding for the properties (Example: Flomar).	PW	Completed (2007)	X		X		X			Revised – action item	
FLD 4	Prepare a Master Plan of Storm Drainage to assess surface water flow which will consider historic and future drainage problems and published floodplain maps.	PW – Engineering Division	5 years	X					High	GF	Seeking funding	GF
FLD 5	Continue to promote and adhere to the standards associated with the National Flood Insurance Program.	CD, PW	Ongoing	X	X	X	X	X	High	CB		CB
Wildfire Mitigation Action Items												

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
WF 1	Develop plan to increase the efficiency of wildfire evacuation.	Police Department (PD), LACFD	1 year	X				X	Med	CB	Revised – action item, coordinating organization	CB
WF 2	Inventory flow at hydrants and prioritize facility improvements to increase water pressure (1,000 flow tests on fire hydrants completed in 2006).	PW – Water Division	Ongoing (Annual)	X				X	High	CB, GF		CB, GF
WF 3	Encourage dissemination of maps relating to the fire hazard to help educate and assist builders and homeowners. (Example: inform property owners in the Very High Fire Hazard Zone of defensible space and other mitigation	CD, LACFD	Ongoing	X	X	X	X	X	High	CB	Revised – action item	CB

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	protocols)											
WF 4	Continue to promote communication, coordination and collaboration between wildland/urban interface property owners, local planners and the Los Angeles County Fire Department to address risks and mitigation measures.	ESC, LACFD	Ongoing	X	X	X	X	X	Med	CB		CB
WF 5	Develop an Urban Water Management Plan (UWMP).	LACFD, PW	Completed	X	X	X	X	X	High		Completed 2008, Updated 2015	
WF 6	Implement Master Water Plan	LACFD, PW	Ongoing	X	X	X	X	X	High	CB, GF	Revised - timeline	CB, GF
WF 7	Development outreach program to push information to owners/tenants	LACFD	1 year	X	X	X	X	X	High	CB, GF	New	CB, GF

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	located in the Very High Fire Hazard Zone. Utilize City website and other resources.											
Drought Mitigation Action Items												
DR 1	Develop and enforce the City's Water Conservation Ordinance (May 2015)	CD, PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP
DR 2	Assess Vulnerability to Drought Risks: ▪ Gathering and analyzing water and climate data to gain a better understanding of local climate and drought history. ▪ Identifying factors that affect the severity of a drought.	PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	▪ Identifying available water supplies. ▪ Determining how the community and its water sources have been impacted by droughts in the past.											
DR 3	Monitor Drought Conditions: ▪ Identify local drought indicators, such as precipitation, temperature, surface water levels, soil moisture, etc. ▪ Establish a regular schedule to monitor and report conditions on at least a monthly basis.	PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
DR 4	Monitor Water Supply: ▪ Regularly checking for leaks to minimize water supply losses. ▪ Improving water supply monitoring.	PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP
DR 5	Plan for Drought: ▪ Developing a drought emergency plan. ▪ Developing criteria or triggers for drought-related actions. ▪ Developing a drought communication plan and early warning system to facilitate timely communication of relevant information to officials, decision makers, emergency	PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	managers, and the general public. ▪ Developing agreements for secondary water sources that may be used during drought conditions. ▪ Establishing an irrigation time/scheduling program or process so that all agricultural land gets the required amount of water. Through incremental timing, each area is irrigated at different times so that all water is not consumed at the same time. Spacing usage may also help with recharge											

Action Item Code	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed					Rank - Low, Med, High	Funding Source (u/k = unknown, CB = City Budget, GF = Grant Funded)	2016 Comments (Status - Completed, Revised, Deleted, New, and Deferred)	Planning/Policy Mechanism (HMP=Hazard Mitigation Plan, GP=General Plan, CIP=Capital Improvement Plan, CB=City Budget, GF=Grant Funded), UWMP=(Urban water Management Plan)
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	of groundwater.											
DR 6	Encourage Water Conservation During Drought Conditions: ▪ Consider adopting ordinances to prioritize or control water use, particularly for emergency situations like fire-fighting.	PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP
DR 7	Consider Retrofit of Water Supply Systems: ▪ Designing water delivery systems to accommodate drought events. ▪ Developing new or upgrading existing water delivery systems to eliminate breaks and leaks.	PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
DR 8	Enhance Landscaping and Design Measures: ▪ Incorporating drought tolerant or xeriscape practices into landscape ordinances to reduce dependence on irrigation. ▪ Encourage use of permeable driveways and surfaces to reduce runoff and promote groundwater recharge.	CD, PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP
DR 9	Educate Residents on Water Saving Techniques: ▪ Installing low-flow water saving showerheads and toilets. ▪ Turning water flow	CD, PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	off while brushing teeth or during other cleaning activities. ▪ Adjusting sprinklers to water the lawn and not the sidewalk or street. ▪ Running the dishwasher and washing machine only when they are full. ▪ Checking for leaks in plumping or dripping faucets. ▪ Installing rain-capturing devices for irrigation. ▪ Encouraging the installation of graywater systems in homes to encourage water reuse.											

Action Item Code	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed					Rank - Low, Med, High	Funding Source (u/k = unknown, CB = City Budget, GF = Grant Funded)	2016 Comments (Status - Completed, Revised, Deleted, New, and Deferred)	Planning/Policy Mechanism (HMP=Hazard Mitigation Plan, GP=General Plan, CIP=Capital Improvement Plan, CB=City Budget, GF=Grant Funded), UWMP=(Urban water Management Plan)
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
DR 10	Water Delivery Systems: When possible, encourage designs or plans for water delivery systems that include consideration for drought events.	PW	Ongoing	X	X	X	X	X	High	GR, CB	New	UWMP
DR 11	Water Saving: citizens can be encouraged to take water-saving measures, especially when extra water is needed for irrigation and farming. Possibilities include installing low-flow water saving showerheads and toilets, and turning water flow off while brushing teeth or	CD	Ongoing	X	X	X	X	X	High	GR, CB	New	CB

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				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
	during other cleaning activities.											
DR 12	Encourage drought tolerant landscaping for new development in the City.	CD, PW	Ongoing	X	X	X	X	X	High	CB	New	UWMP
DR 13	Enforcement of California's Green Building Code that requires low-flow water conservation fixtures.	CD, PW	Ongoing	X	X	X	X	X	High	CB	New	UWMP

Section 9: Planning Process

Plan Methodology*

DMA 2000 emphasizes the importance of participatory planning in the development of Mitigation Plans. This Mitigation Plan was written using the best available information from a wide variety of sources.

Throughout the planning process, the City made a concerted effort to gather information from city and county departments, as well as state and federal agencies, the local business community, Whittier residents, and other stakeholders.

Disaster Mitigation Act of 2000

Requirement §201.6(c) (1)

[The plan shall include…:] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

The Planning Team solicited information from internal and external departments and agencies with specific knowledge of natural hazards and past historical events, as well as planning and zoning codes, ordinances, and recent planning decisions. The hazard mitigation strategies contained in this plan were developed through an extensive planning process involving local businesses and residents.

On November 10, 2015, staff presented the Mitigation Plan to the City Council for consideration. A copy of the City Council Resolution adopting the Mitigation Plan appears in Section 10: Planning Process.

The rest of this section describes the mitigation planning process including 1) Planning Team involvement, 2) extended Planning Team support, 3) public and other stakeholder involvement; and 4) integration of existing data and plans.

Planning Team

The Planning Team met in April, May, and June of 2015 to review the updated requirements associated with DMA 2000, develop a work plan for creating Plan update, provide status reports on the 2010 Mitigation Actions Matrix, and develop new mitigation action items.

Who Participated in Developing the Plan?

The Mitigation Plan is the result of a collaborative planning effort between City of Whittier citizens, public agencies, non-profit organizations, the private sector, regional, and state and federal organizations. Public participation played a key role in development of goals and action items. A Planning Team guided the process of developing the plan and consisted of the following representatives:

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* **ELEMENT A: PLANNING PROCESS | A1**

A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))

Table: Planning Team Timeline

	February 2015	March	Apr il	May	June	July	August	September	October	November	December	January 2016	February-September	October
Request for Proposal Issued	X													
Contracted with Emergency Planning Consultants		X												
Research and Writing of 2015 Plan Update			X	X	X	X	X							
Planning Team Meeting #1			X											
Planning Team Meeting #2				X										
Planning Team Meeting #3					X									
Planning Team Review and Comment on First Draft Plan							X							
Distribute Second Draft for input by Public & External Agencies								X						
Publicize Availability of Third Draft Plan									X					
Public Notice of City Council Public Meeting									X					
Present 2015 Plan Update to City Council at Public Meeting										X				
Submit Adopted Plan to Cal OES/ FEMA for Approval										X				
Receive FEMA Approval														X

Planning Team

The Planning Team consisted of:

- Don Dooley, Community Development Department – Chair of Planning Team
- Greg Alaniz, Parks & Recreation Department
- Dave Edgell, Public Works Department – Streets
- Carl Hassel, Administration
- Sonya Lui, Community Development Department
- Jared Macias, Public Works Department - Water
- Chris Magdosku, Public Works Department - Engineering
- Yolanda Martinez, Controller's Office/Risk & Emergency Management
- Brett Petroff, Controller's Office/Risk & Emergency Management
- Jay Tatman, Police Department
- Devin Trone, Los Angeles County Fire Department
- Carlos Yado, Community Development Department – Building & Safety

Planning Team Meetings

The Team met for three meetings to review the updated requirements of DMA 2000, review the status of mitigation actions identified in the 2010 Natural Hazards Mitigation Plan, develop additional mitigation action items, and develop an updated implementation plan. In addition to the meetings, the entire Planning Team participated in contributing content, editing, and finalizing the Mitigation Plan prior to submission to the City Council.

Table: Planning Team Level of Participation*

	Issue Request for Proposal	Contract with Emergency Planning Consultants	Research and Writing of 2015 Plan Update	Planning Team Meeting #1 (4.13.15)	Planning Team Meeting #2 (5.12.15)	Planning Team Meeting #3 (6.9.15)	Review and Comment on Draft Plan	Attend City Council Public Meeting	Submit Adopted Plan to Cal OES/FEMA for Approval	Receive FEMA Approval
City and County Staff										
Don Dooley, Planning Services Manager, Community Development Department – Chair of Planning Team	X	X	X	X	X	X	X	X	X	X
Greg Alaniz, Parks & Recreation Department			X	X	X		X			
Dave Edgell, Public Works Department – Streets			X	X	X		X			
Carl Hassel, Administration			X		X	X	X			
Sonya Lui, Community Development Department			X	X	X	X	X			
Jared Malias, Public Works Department - Water			X	X	X		X			

* **ELEMENT A: PLANNING PROCESS | A1**

A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))

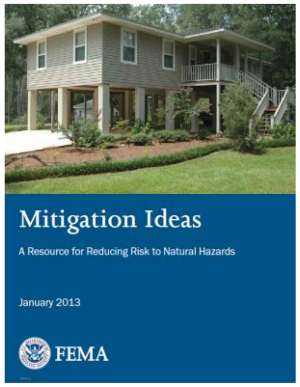
	Issue Request for Proposal	Contract with Emergency Planning Consultants	Research and Writing of 2015 Plan Update	Planning Team Meeting #1 (4.13.15)	Planning Team Meeting #2 (5.12.15)	Planning Team Meeting #3 (6.9.15)	Review and Comment on Draft Plan	Attend City Council Public Meeting	Submit Adopted Plan to Cal OES/FEMA for Approval	Receive FEMA Approval
Chris Magdosku, Public Works Department - Engineering			X	X	X	X	X			
Yolanda Martinez, Controller's Office/Risk & Emergency Management			X		X	X	X			
Brett Petroff, Controller's Office/Risk & Emergency Management			X		X		X			
Jay Tatman, Police Department			X	X	X		X			
Devin Trone, Los Angeles County Fire Department			X	X	X	X	X			
Carlos Yado, Community Development Department – Building & Safety			X	X	X	X	X			
Consulting Staff										
Carolyn Harshman, Emergency Planning Consultants		X	X	X	X	X		X	X	X

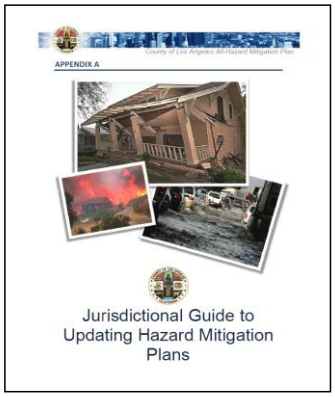
Following is a listing of the meetings attended by City of Whittier staff concerning development of the Natural Hazards Mitigation Plan:

Date: April 13, 2015
Location: City of Whittier – City Council Chambers
Facilitated by: Emergency Planning Consultants
Topic: Kick-Off Meeting and Planning Process
Carolyn Harshman delivered an overview of the hazard mitigation planning process for the benefit of Planning Team members not involved in the preparation of the 2010 Hazard Mitigation Plan. The meeting also involved an overview of the Initial Risk Assessment and ranking of hazards.

Date: May 12, 2015
Location: City of Whittier – City Council Chambers
Facilitated by: Emergency Planning Consultants
Topic: Existing and Future Mitigation Action Items
Carolyn Harshman facilitated a workshop reviewing the status of the 2010 Mitigation Action Items as well as development new action items. There was an extensive discussion on various methods of engaging the public in the mitigation process.

Date: June 9, 2015
Location: City of Whittier – City Council Chambers
Facilitated by: Emergency Planning Consultants
Topic: Existing and Future Mitigation Action Items
Carolyn Harshman facilitated a workshop continuing development of new action items. The Planning Team discussed plan implementation and agreed that the Planning Team should meet on a quarterly basis to ensure plan implementation (see Section 4: Plan Maintenance). Team members will provide project direction and oversight and assist with plan evaluation. In addition to providing status on the 2010 mitigation action items, the team reviewed lists of action item ideas from two documents: 1) County of Los Angeles All-Hazard Mitigation Plan – Appendix B: Jurisdictional Guide to Updating Hazard Mitigation Plans, and 2) FEMA's Mitigation Ideas – a Resource for Reducing Risk to Natural Hazards.





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Planning Team Involvement

The Planning Team was responsible for the following tasks:

- ✓ Establish plan development goals
- ✓ Prepare timetable for plan completion
- ✓ Ensure plan meets DMA 2000 requirements, and federal and state guidelines
- ✓ Organize and oversee public involvement
- ✓ Solicit participation of government agencies, businesses, residents, and other stakeholders

- ✓ Gather information (such as existing data and reports)
- ✓ Develop, revise, adopt, and maintain plan
- ✓ Participate in Committee meetings and City County public meeting

The Planning Team, with support from other City staff and local organizations, identified and profiled hazards; determined hazard rankings; estimated potential exposure or losses; evaluated development trends and specific risks; and developed mitigation goals, objectives, and activities.

During its meetings the Planning Team gathered and shared information, assessed risks, identified critical facilities, developed mitigation strategies, and provided continuity throughout plan development to ensure the plan addresses jurisdiction-specific hazard vulnerabilities and mitigation strategies. Members communicated regularly by phone and email between group meetings.

The Planning Team will meet annually after the plan is adopted. Members will provide project direction and oversight, assist with plan evaluation, and convene supplementary meetings as-needed.

Outside Agency Involvement*

During the plan writing phase, the second draft plan was made available to outside agencies and individuals who provided data and expertise during the plan writing process. The only feedback received on the second draft plan were minor typographical. These items were incorporated into the third draft plan. The invitation and invitee list of outside agencies are attached to this Section.

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* **ELEMENT A: PLANNING PROCESS | A2**

A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))

State and Federal Guidelines and Requirements for Mitigation Plans

Following are the Federal requirements for approval of a mitigation plan:

- ✓ Open public involvement, with public meetings that introduce the process and project requirements.
- ✓ The public must be afforded opportunities for involvement in identifying and assessing risk, drafting a plan, and public involvement in approval stages of the plan.
- ✓ Community cooperation with an opportunity for other local government agencies, the business community, educational institutions, and non-profits to participate in the process.
- ✓ Incorporation of local documentation including the local General Plan, the Zoning Ordinance, the Building Codes, and other pertinent documents.

To facilitate communication between the Planning Team and Whittier residents, and to involve the public in ongoing planning and evaluation, this plan will be available to the public through a variety of venues.

The following components must be part of the planning process:

- ✓ Complete documentation of the planning process
- ✓ A detailed risk assessment on hazard exposures in the City
- ✓ A comprehensive mitigation strategy, which describes the goals and objectives, including proposed strategies, programs and actions to avoid long-term vulnerabilities
- ✓ A plan maintenance process, which describes the method and schedule of monitoring, evaluating and updating the plan and integration of the Mitigation Plan into other planning mechanisms
- ✓ Formal adoption by the City Council
- ✓ Plan review by Cal OES
- ✓ Plan approval by FEMA

These requirements are identified in greater detail in the following plan sections and supporting documentation.

Public participation opportunities were created through distribution of the plan to the public and external agencies during the plan writing phase. In addition, the makeup of a Planning Team ensured a constant exchange of data and input from internal and external organizations. Through its consultant, Emergency Planning Consultants, the City had access to numerous existing mitigation plans from around the country, as well as current FEMA Mitigation Planning standards (386 series) and the State of California Mitigation Plan Guidance.

Other reference materials consisted of state, county, and city mitigation plans, including:

- ✓ County of Los Angeles All-Hazard Mitigation Plan (2014)
- ✓ State of California Natural Hazards Mitigation Plan (2013)

Hazard specific research: City staff collected data and compiled research on four hazards: earthquakes, floods, wildfires, and drought.

Research materials came from the City's General Plan, the City's Hazard Analysis contained in the Emergency Operations Plan, and state agencies including Cal OES and CAL FIRE. The City of Whittier staff conducted research by locating City of Whittier information in historical documents. Information was also incorporated from after-action documentation provided for previous proclaimed and declared disasters. The City of Whittier staff identified current mitigation activities, resources, and programs, and potential action items from research materials and stakeholder interviews.

Hazard Mitigation Programs

The City of Whittier adheres to the Stafford Act, the California Emergency Services Act, and DMA 2000, which require local governments to develop and implement Mitigation Plans. Cities and counties have intimate knowledge of local geography, and they are on the front line with personnel and equipment during a disaster. Local governments are in the best position to assess their strengths, weaknesses, opportunities, and constraints.

Coordination with Federal Policies

The City is involved in the NFIP, which helps the City receive funding for flood insurance and flood mitigation projects. Data from the NFIP was used in the risk assessment, resulting in a number of mitigation activities. The City's continued involvement in NFIP supports this plan.

National Flood Insurance Program

Established in 1968, the NFIP provides federally-backed flood insurance to homeowners, renters, and businesses in communities that adopt and enforce floodplain management ordinances to reduce future flood damage. The City of Whittier adopted a floodplain management ordinance and has Flood Insurance Rate Maps (FIRM) that show floodways, 100-year flood zones, and 500-year flood zones. The Public Works Director is designated as floodplain administrator.

Current Mitigation Programs

The City intends to incorporate mitigation planning as an integral component of daily operations; the Planning Team will work to integrate mitigation strategies into the general operations of the City and partner organizations. After conducting a capability assessment (Section 3: Risk Assessment), the Planning Team will identify additional policies, programs, practices, and procedures that could be modified to address mitigation activities. In addition, the City intends to implement the plan through its involvement in FEMA and Cal OES programs. Table: Existing Processes and Programs identifies existing processes/programs through which the plan could be implemented.

Table: Existing Processes and Programs*

Process	Action	*Implementation of Plan*
Administrative	Departmental or organizational work plans, policies, and procedural changes	✓ *City Manager's Office* ✓ *Planning Services Division* ✓ *Public Works Department* ✓ *Other departments as appropriate*
Administrative	Other plans	✓ *Reference plan in Emergency Operations Plan* ✓ *Address plan findings and incorporate mitigation activities in General Plan*
Budgetary	Capital and operational budgets	✓ *Include line item mitigation measures in budget as appropriate*
Regulatory	Executive orders, ordinances, and other directives	✓ *Building Code* ✓ *Capital Improvement Plan (Require hazard mitigation in design of new construction)* ✓ *Comprehensive Planning (Institutionalize hazard mitigation in land use and new construction)* ✓ *National Flood Insurance Program* ✓ *Water Quality Management Plan* ✓ *Urban Water Management Plan* ✓ *Zoning Ordinance*
Funding	Traditional and nontraditional sources	✓ *Once plan is approved, seek authority to use bonds, fees, loans, and taxes to finance projects* ✓ *Seek assistance from federal and state government, foundation, nonprofit, and private sources, such as Hazard Mitigation Grant Program* ✓ *Research grant opportunities through U.S. Department of Housing and Urban Development, Community Development Block Grant*
Partnerships	Creative funding and initiatives	✓ *Community volunteers* ✓ *In-kind resources* ✓ *Public-private partnerships* ✓ *State support*
Partnerships	Advisory bodies and committees	✓ *Emergency Management Ad Hoc Committee* ✓ *Inter-Agency Coordination Group* ✓ *Safety Committee*

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* **ELEMENT C. MITIGATION STRATEGY | C1**

C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))

In addition to being required by DMA 2000, adoption of the plan is necessary because:

- ✓ It lends authority to the plan to serve as a guiding document for all local and state government officials;
- ✓ It gives legal status to the plan in the event it is challenged in court;
- ✓ It certifies to program and grant administrators that the plan's recommendations have been properly considered and approved by the governing authority and jurisdictions' citizens; and
- ✓ It helps to ensure the continuity of mitigation programs and policies over time because elected officials, staff, and other community decision-makers can refer to the official document when making decisions about the community's future.

Source: FEMA. 2003. "How to Series" - *Bringing the Plan to Life* (FEMA 386-4)

Use of Existing Data*

The Planning Team gathered and reviewed existing data and plans during plan development. Numerous electronic and hard copy documents were used to support the planning process:

- ✓ City of Whittier
- ✓ County of Los Angeles General Plan, (2005)
- ✓ County of Los Angeles All-Hazards Mitigation Plan, (2014)
- ✓ State of California Hazard Mitigation Plan, (2013)
- ✓ FEMA's Mitigation Ideas – a Resource for Reducing Risk to Natural Hazards
- ✓ HAZUS reports (County of Los Angeles)
- ✓ Historic GIS maps and local inventory data
- ✓ Local Flood Insurance Rate Maps

These documents were used as resources throughout the Plan (See "Sources" for maps, tables, etc. throughout the Plan)

Federal Data

A variety of federal data was collected and used throughout the mitigation planning process:

- ✓ Census data
- ✓ FEMA "How To" Mitigation Series (386-1 to 386-9)
- ✓ National Oceanic and Atmospheric Administration statistics

The Planning Team also examined public laws and programs (such as the National Flood Insurance Program) during plan development.

A list of existing data and plans used to support the mitigation planning effort appears in Appendix: Resource Directory. The length of this list demonstrates the importance of mitigation planning in existing programs. Implementing the plan through existing programs is identified as a mitigation action in Section 9: Mitigation Strategies. A description of the implementation process and potential funding sources is provided.

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* **ELEMENT A: PLANNING PROCESS | A4**

A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))

Invitation Process

The Planning Team identified possible public notice sources. The Agenda Item concerning the Plan's presentation to participate in the plan writing process was posted on the City website. In addition, the opportunity was posted at City Hall and the Library. Invitations to representative of external agencies were distributed via email.

The same noticing protocols were followed for the City Council public meeting.

City Council Public Meeting

City of Whittier conducted one public meeting concerning the update of the Mitigation Plan. The City Council heard the item on November 10, 2015.

Plan Adoption Process

Adoption of the plan by the local governing body demonstrates the City's commitment to meeting mitigation goals and objectives. Governing body approval legitimizes the plan and authorizes responsible agencies to execute their responsibilities.

The City Council must adopt the Mitigation Plan before the Plan can be approved by FEMA. The resolution of adoption by the City Council is in Section 9: Planning Process.

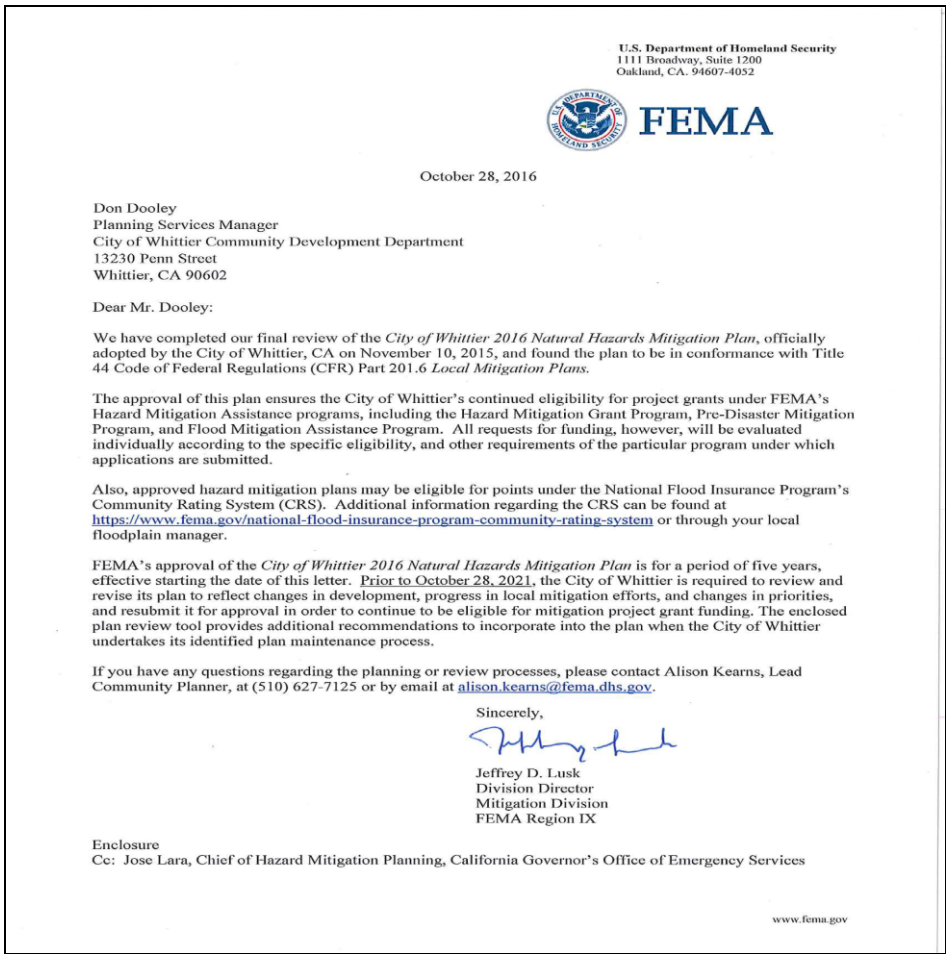
The Planning Team prepared a staff report on the Plan, including an overview of the Hazard Analysis, Mitigation Goals, and Mitigation Actions. The staff report concluded with a summary of the input received during the plan writing phase and the public noticing phase. The meeting participants were encouraged to present their views and make suggestions on possible mitigation actions.

The Council was supportive of the overall goal established by the Planning Team to become a more disaster resilient community. The City Council commended the Planning Team representatives for its dedication and efforts to satisfy the DMA 2000 requirements. The City Council voted unanimously for the adoption of the Mitigation Plan.

Plan Approval

The City-Council adopted Plan was submitted to Cal OES for review. Mandated revisions were made and the Plan forwarded to FEMA for review. FEMA approved the Plan on October 27, 2016 (see Section 9: Planning Process - Attachments).

Attachment: FEMA Letter of Approval



U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA. 94607-4052

FEMA

October 28, 2016

Don Dooley
Planning Services Manager
City of Whittier Community Development Department
13230 Penn Street
Whittier, CA 90602

Dear Mr. Dooley:

We have completed our final review of the *City of Whittier 2016 Natural Hazards Mitigation Plan*, officially adopted by the City of Whittier, CA on November 10, 2015, and found the plan to be in conformance with Title 44 Code of Federal Regulations (CFR) Part 201.6 *Local Mitigation Plans.*

The approval of this plan ensures the City of Whittier's continued eligibility for project grants under FEMA's Hazard Mitigation Assistance programs, including the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program. All requests for funding, however, will be evaluated individually according to the specific eligibility, and other requirements of the particular program under which applications are submitted.

Also, approved hazard mitigation plans may be eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Additional information regarding the CRS can be found at https://www.fema.gov/national-flood-insurance-program-community-rating-system or through your local floodplain manager.

FEMA's approval of the *City of Whittier 2016 Natural Hazards Mitigation Plan* is for a period of five years, effective starting the date of this letter. Prior to October 28, 2021, the City of Whittier is required to review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval in order to continue to be eligible for mitigation project grant funding. The enclosed plan review tool provides additional recommendations to incorporate into the plan when the City of Whittier undertakes its identified plan maintenance process.

If you have any questions regarding the planning or review processes, please contact Alison Kearns, Lead Community Planner, at (510) 627-7125 or by email at alison.kearns@fema.dhs.gov.

Sincerely,

Jeffrey D. Lusk
Division Director
Mitigation Division
FEMA Region IX

Enclosure
Cc: Jose Lara, Chief of Hazard Mitigation Planning, California Governor's Office of Emergency Services

www.fema.gov

Attachment: External Agency Reviewers

External reviewers listed below were provided with an electronic link to the Second Draft Plan and asked to provide input directly to Don Dooley, Planning Services Manager. Following is a sample of the email distributed along with the invitation to comments. The only feedback received was minor typographical suggestions that were gathered and incorporated into the Third Draft Plan prior to submission to City Council. Below is the list of invited External Agencies.

External Agency Reviewers		
Agency	**Name**	**Job Title**
Whittier College	Sharon Herzberger	President
Rio Hondo College	Jim Poper	Director of Facilities
County of Los Angeles Planning	Mark Herwick	Regional Planning Supervisor
City of La Habra	Jim Sadro	City Manager
City of La Habra Heights	Shauna Clark	City Manager
City of La Mirada	Jeff Boynton	City Manager
City of Pico Rivera	René Bobadilla	City Manager
City of Santa Fe Springs	Thaddeus McCormack	City Manager
Los Angeles Sanitation District	Grace Robinson Hyde	Chief Engineer and General Manager
Los Angeles County Public Works Department	Gail Farber	Director of Public Works
Presbyterian Intercommunity Hospital	Dave Klinger	VP Facilities & Real Estate
California Domestic Water Company	Jim Byerrum	President
Suburban Water Systems	Tom Medina	Construction Manager
Charter Communications	Tom Adams	Executive Vice President, Field Operations
Verizon FIOS	Jeff McLuckey	Sales Operation Supervisor
Southern California Edison	Javier Rameriz	Construction Maintenance Manager
Southern California Gas Company	Julia Emerson	Public Affairs Manager
Whittier City School District	Jon McNeil	Assistant Superintendent
East Whittier City School District	Drew Passalacqua, Ed.D.	Director, Administrative Services
South Whittier School District	Mark Kerikous	Assistant Superintendent of Business Services
Los Nietos School District	Jonathan Vasquez	Superintendent
Whittier Union High School District	David Pasillas	Manager of Maintenance, Operations & Energy Education
Fullerton Union High School District	Javier Sierra	Director of Maintenance and Operations

Attachment: Email Invitation to External Agency Reviewers

From: ddooley@cityofwhittier.org [mailto:ddooley@cityofwhittier.org]
Sent: Wednesday, September 23, 2015 1:14 PM
To: Herzberger
Sharon; JPoper@riohondo.edu; Mherwick@planning.lacounty.gov; jsadro@lahabraca.gov; ShaunaC@Lhhcity.org;Jboynton@cityoflamirada.org; rbobadilla@pico-rivera.org; thaddeusmccormack@santafesprings.org; ghyde@lacsd.org;gfarber@dpw.lacounty.gov; Dave.Klinger@pihhealth.org; JByerrum@cdwc.com; tmedina@swwc.com; tadams@charter.net;jeff.mcluckey@vzw.com; Javier.rameriz@sce.com; jemerson@siemprautilities.com; jmcneil@whittiercity.net; dpassalacqua@ewcsd.org;mkeriakous@swhittier.net; david.pasillas@wuhsd.org; jsierra@fjuhsd.net; cmcnamara@cityofwhittier.org
Subject: City of Whittier's Draft 2015 Natural Hazards Mitigation Plan Update - Request for Comments

The City of Whittier is in the process of updating its 2010 Natural Hazards Mitigation Plan (NHMP) or "Hazard Mitigation Plan." The document was prepared in response to Congress' Disaster Mitigation Act (DMA) of 2000. The DMA requires State and local governments to prepare hazard mitigation plans to document their hazard mitigation planning process and identify hazards, potential losses, mitigation needs, goals, and strategies.

Please find attached to this e-mail the City of Whittier's Draft 2015 Hazard Mitigation Plan. As you are a service provider to the City of Whittier or because you are an adjoining local jurisdiction, your comments, suggestions and input into City's Draft 2015 Hazard Mitigation Plan is requested.

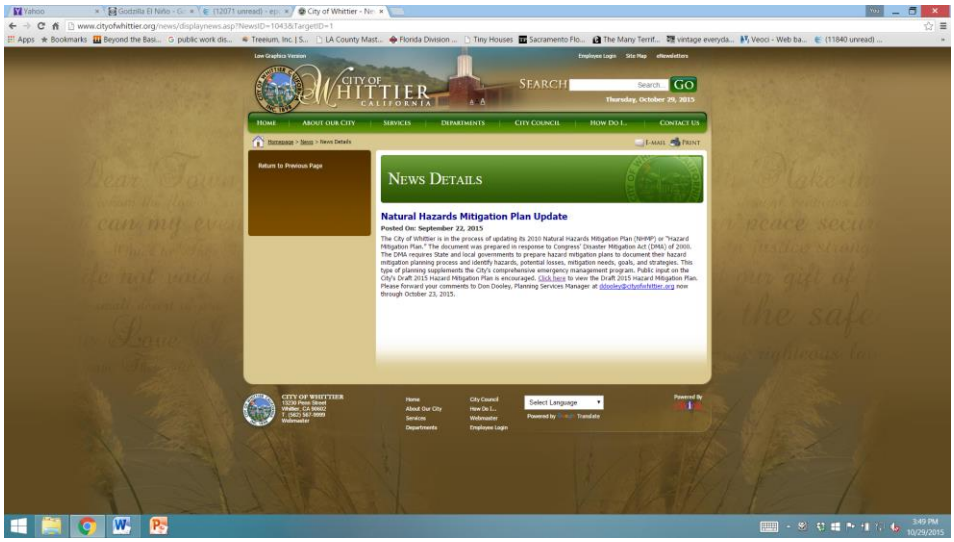
If you would kindly forward any comments you may back to me by Friday, October 23, 2015, it would be greatly appreciated. If you have any questions, please do not hesitate to contact me.

Many thanks!

Sincerely,

Don Dooley, Planning Services Manager
13230 Penn Street
Whittier, California 90602
Tel: (562) 567-9342
Fax: (562) 567-2872

Attachment: City Website Posting Draft Mitigation Plan



Attachment: Noticing for City Council Public Hearing

Legal No. 0010723971

NOTICE OF PUBLIC AVAILABILITY FOR REVIEW AND COMMENT ON THE 2015 UPDATE TO THE CITY OF WHITTIER'S NATURAL HAZARDS MITIGATION PLAN

The City of Whittier is in the process of updating its 2010 Natural Hazards Mitigation Plan (NHMP) or "Hazard Mitigation Plan." The document was prepared in response to Congress' Disaster Mitigation Act (DMA) of 2000. The DMA requires State and local governments to prepare hazard mitigation plans to document their hazard mitigation planning process and identify hazards, potential losses, mitigation needs, goals, and strategies. Public input on the City's Draft 2015 Hazard Mitigation Plan Update is encouraged. The document is available for review on the City of Whittier's website at: http://www.cityofwhittier.org as well as at Whittier City Hall (Community Development Department) located at 13230 Penn Street, Whittier, CA. Copies of the Draft Hazard Mitigation Plan are also available at the reference desk at the Whittwood Branch Public Library located at: 10537 Santa Gertrudes Ave, Whittier, CA and at the Whittier Public Library located at 7344 Washington Ave, Whittier, CA. Please forward your comments to Don Dooley, Planning Services Manager at ddooley@cityofwhittier.org now through November 10, 2015.

Don Dooley,
Planning Services Manager

Publish: Oct 13, 2015 Whittier Daily News #723971

Attachment: City Council Staff Report

Agenda Report

Date: November 10, 2015

To: Jeffrey W. Collier, City Manager

From: Conal McNamara, Community Development Director

Subject: 2015 City of Whittier Natural Hazards Mitigation Plan Update

RECOMMENDATION

Staff recommends that the City Council adopt the attached Resolution approving the 2015 City of Whittier Natural Hazards Mitigation Plan Update.

BACKGROUND

The City of Whittier's Natural Hazards Mitigation Plan (NHMP) or "Hazard Mitigation Plan" was prepared in response to Congress' Disaster Mitigation Act (DMA) of 2000. The DMA requires state and local governments to prepare hazard mitigation plans to document their hazard mitigation planning process, identify hazards, potential losses, mitigation needs, goals, and strategies. This type of planning supplements the City's comprehensive emergency management program.

Under DMA 2000, each state and local government must have a federally approved hazard mitigation plan to be eligible for hazard mitigation grant funding. To comply, the City of Whittier developed its original Hazard Mitigation Plan in 2004 and an update in 2010, which is now being superseded by the proposed 2015 NHMP update. The Federal Emergency Management Agency (FEMA) mandates updates every five years.

Whittier's NHMP is organized into three parts. Part I: Background contains an Introduction and Community Profile; Part II: Hazard Analysis contains Risk Assessment and Hazard-Specific Sections; Part III: Mitigation Strategies contains Mitigation Strategies, Planning Process, and Plan Maintenance; and Part IV: Appendices.

The City's Hazard Mitigation Planning Team (Planning Team), consisting of City staff from various departments used FEMA's guidelines to accomplish the following:

- Develop a Planning Team;
- Identify hazards of concern (particularly floods, fires and earthquakes);
- Profile these hazards;
- Estimate inventory at risk and potential losses associated with these hazards;
- Develop mitigation strategies and goals that address these hazards; and,
- Develop plan maintenance procedures for implementation after the California Office of Emergency Services (Cal OES) review and the Federal Emergency Management Agency (FEMA) approves the mitigation plan.

As required by DMA 2000, the City has proactively notified the community about the City's hazard mitigation planning process and solicited public comments/input (between

Agenda Item: _____

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_____, 2015, to _____, 2015) through a variety of different methods such as: advertising on the City's cable channel, website, newsletter, the Whittier Daily News, and within Whittier City Hall and its libraries. In addition, key emergency responders such as the Los Angeles County Fire Department and the Whittier Police Department shared their expertise during the planning process with the community. Therefore, the attached 2015 Natural Hazards Mitigation Plan documents the process and outcome of the City's mitigation planning efforts.

It is also important to note that the City will continue to incorporate mitigation planning as an integral component of City operations through existing processes, procedures and programs, as identified in the Mitigation Actions Matrix. Emphasis on mitigating earthquakes, floods, wildfires, and drought have been given particular attention, as these four natural hazards have historically posed the greatest threats to Whittier.

As part of the 2015 Plan update, the Planning Team also identified five mitigation goals that summarize the hazard reduction outcomes desired. These include:

- Protecting Life and Property;
- Enhancing Public Awareness;
- Protecting Natural Systems;
- Increasing Partnerships and Implementation; and,
- Improving Emergency Services

These goals, along with their corresponding objectives, guided the development and implementation of specific mitigation activities. In fact, many of the mitigation objectives and action items come from current programs. Emphasis was also placed on the effectiveness of the activities with respect to their estimated cost(s). Existing documents including the City's General Plan, County of Los Angeles All-Hazards Mitigation Plan, and the State of California Hazard Mitigation Plan all served as resources throughout the update process.

DISCUSSION

No public comments were received concerning Whittier's proposed 2015 NHMP update. Once adopted by the City Council, the document will be forwarded to Cal OES for review and submission to FEMA for approval.

FISCAL IMPACT

City Council approval and FEMA certification of the City's 2015 Natural Hazards Mitigation Plan Update will allow the City of Whittier to be eligible to receive untold money in Federal assistance in the event of a natural disaster in the City. Failure to approve the document or to receive certification from FEMA could cost the City significant sums of money that would not be reimbursable through FEMA in the event of a natural disaster in the City.

Submitted by:

_____
Conal McNamara
Community Development Director

Prepared by:

_____
Don Dooley
Planning Services Manager

Attachments:

A) Draft City Council Resolution
B) Proposed 2015 City of Whittier Natural Hazards Mitigation Plan Update (dated November 10, 2015).

Attachment: City Council Resolution

RESOLUTION NO. 8741

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF WHITTIER, CALIFORNIA, ADOPTING ITS 2015 NATURAL HAZARDS MITIGATION PLAN UPDATE

WHEREAS, the Whittier City Council originally adopted the City's Natural Hazards Mitigation Plan (NHMP) on September 14, 2004, under City Council Resolution No. 7712, pursuant to the Federal Disaster Management Act of 2000;

WHEREAS, the City of Whittier's current NHMP was adopted by the City Council on March 23, 2010, under City Council Resolution No. 8275;

WHEREAS, the City's NHMP focuses on the potential impacts of earthquakes, floods and wildfires in addition to including an assessment of these natural hazards, a plan to mitigate them, and methods of monitoring, evaluating and continuing to update the City's NHMP at least every five years;

WHEREAS, the City's 2015 NHMP update was formally noticed to the community of its availability for public review and comment through a variety of different outlets such as: the City's website, cable channel, the Whittier Daily News, within Whittier City Hall, and in all City of Whittier libraries (between September 23, 2015, through October 23, 2015) to solicit the community's input into the City's 2015 NHMP update;

WHEREAS, the City's 2015 NHMP update has been determined to be Categorically Exempt pursuant to Section 15308 (Class 8 – Actions by Regulatory Agencies for Protection of the Environment) of the California Environmental Quality Act; and

WHEREAS, the City Council conducted a duly noticed public hearing on the City's 2015 NHMP update at its regularly scheduled meeting of November 10, 2015, and fully reviewed and considered all changes to the document after opening up the public hearing and taking all public testimony as well as reviewing all written comments received concerning the document.

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF WHITTIER, CALIFORNIA, DOES RESOLVE AS FOLLOWS:

SECTION 1. The City Council has determined that the 2015 City of Whittier NHMP update is complete and adequate and complies with all State and Federal requirements.

SECTION 2. The City Council does hereby authorize the City Manager to amend and update the 2015 Whittier NHMP as required by Cal OES and/or FEMA for certification of the adopted Plan and to initiate implementation of the NHMP in

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conjunction with making any necessary corrections/modifications to the document as required by changes in hazards or the City's capability to mitigate against hazards.

SECTION 3. The City Council does authorize the City Clerk-Treasurer to certify to the passage and adoption of this resolution for the City's 2015 NHMP update and to forward a copy of the City's 2015 NHMP update to Cal OES and FEMA for certification.

APPROVED AND ADOPTED this 10th day of November 2015.

FERNANDO DUTRA, Mayor

ATTEST:

KATHRYN A. MARSHALL
City Clerk-Treasurer

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CITY OF WHITTIER)
) SS
STATE OF CALIFORNIA)

I, Kathryn A. Marshall, City Clerk-Treasurer in and for the City of Whittier, California, hereby certify that the foregoing resolution was duly introduced and adopted at a regular meeting of the City Council of said City held on the 10th day of November 2015, by the following roll call vote:

AYES:	O. Newcomer	C. Warner	R.L. Henderson
	J.A. Vinatieri	F. Dutra	
NOES:	None		
ABSENT:	None		

WITNESS my hand and the official seal of the City of Whittier, California, this 14th day of November 2015.

Kathryn A. Marshall
KATHRYN A. MARSHALL
City Clerk-Treasurer

I HEREBY CERTIFY THIS TO BE A TRUE AND CORRECT COPY OF THE ORIGINAL DOCUMENT ON FILE WITH THE CITY OF WHITTIER. WITNESS MY HAND AND THE OFFICIAL SEAL OF THE CITY OF WHITTIER THIS 17th DAY OF November, 2015.
Maritza Morales
DEPUTY CITY CLERK

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City of Whittier
Hazard Mitigation Plan Update Planning Team
April 13, 2015

Name	Department
CAROLYN HARSHMAN	EMERGENCY PLANNING CONSULTANTS
GREG ALANIZ	PARKS + RECREATION
CHRIS MAGDOSKU	PUBLIC WORKS / ENGINEERING
David Edgell	Public works / STREETS
JAY TATMAN	POLICE
Sonya Lui	Community Development
SAEED MALAS	PUBLIC WORKS - WATER
DON DOOLEY	COMMUNITY DEVELOPMENT DEPT. (PLANNING)
Carlos Yado	CDD (Building & Safety)
DEVIN TROUE	FIRE dtroue@fire.lacounty.gov

City of Whittier
Hazard Mitigation Plan Update Planning Team
May 12, 2015

Name	Department
CAROLYN HARSHMAN	EMERGENCY PLANNING CONSULTANTS
Sonya Hui	Community Development
DEVIN TRONE	LA COUNTY FIRE
Greg Alaniz	Parks, Rec., & Community Services
JAY TATMAN	POLICE
JARED MACIAS	PUBLIC WORKS
CARL HASSEN	ADMIN.
Brett Retnaff	Controllers/Emergency Management
Yolanda Martinez	Controllers/Risk & EM Div.
David Edgell	P/W STREETS
CHRIS MAGDOSKU	PUBLIC WORKS, ENGINEERING DIV.
Carlos Yado	Building & Safety
DON DOBLEY	COMMUNITY DEVELOPMENT (PLANNING)

City of Whittier
Hazard Mitigation Plan Update Planning Team
June 9, 2015

Name	Department
CAROLYN HARSHMAN	EMERGENCY PLANNING CONSULTANTS
CHRIS MAGDOSKU	PUBLIC WORKS-ENGINEERING
CARL HASSEL	CM's OFFICE
DON DOOLEY	Community Development
YOLANDA MARTINEZ	CONTROLLERS
Carlos Yado	B&S
Sonya Lui	Community Development

Section 11: Plan Maintenance

The Plan Maintenance section of this document details the formal process that will ensure that the Mitigation Plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the Plan annually and producing a plan revision every five years. This section describes how the City will integrate public participation throughout the plan maintenance process.

Method and Scheduling of Plan Implementation*

The Planning Team that was involved in research and writing of the Plan will also be responsible for implementation. The Planning Team will be led jointly by the Planning Services Manager and the Human Resources & Risk/Emergency Manager (Joint Chairs). Please refer to the Credits on page 2 of the Plan for a full list of Planning Team members.

	Year 1	Year 2	Year 3	Year 4	Year 5
Monitoring	X	X	X	X	X
Evaluating					
Internal Planning Team Evaluation	X	X	X	X	X
Cal OES and FEMA Evaluation					X
Updating	X	X	X	X	X

Monitoring and Implementing the Plan

Plan Adoption

Adoption of the Mitigation Plan by the City's governing body is one of the prime requirements for approval of the plan. Once the plan is completed, the City Council will be responsible for adopting the Mitigation Plan. The governing body has the responsibility and authority to promote sound public policy regarding hazards. The local agency governing body will have the authority to periodically update the plan as it is revised to meet changes in the hazard risks and exposures in the City. The approved Mitigation Plan will be significant in the future growth and development of the City.

The City Council will be responsible for adopting the Mitigation Plan. This governing body has the authority to promote sound public policy regarding hazards. Once the plan has been adopted, the Joint Chairs will be responsible for submitting it to the State Hazard Mitigation Officer at California Office of Emergency Services (Cal OES) for review. Cal OES will then submit the plan to the Federal Emergency Management Agency (FEMA) for approval. This review will address the requirements set forth in 44 C.F.R. Section 201.6 (Local Mitigation Plans). Upon acceptance by FEMA, City of Whittier will gain eligibility for Hazard Mitigation Grant Program funds.

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* **ELEMENT A: PLANNING PROCESS | A6**

A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))

Convener

The City Council will adopt the Mitigation Plan and the Planning Team will take responsibility for plan maintenance and implementation. The Planning Services Manager, will serve as a convener to facilitate the Planning Team meetings, and will assign tasks such as updating and presenting the Plan to the members of the Planning Team. Plan implementation and evaluation will be a shared responsibility among all of the Planning Team members. The Planning Services Manager will have authority to prepare and approve future amendments to the Mitigation Plan with 5-year updates to FEMA resubmitted to the City Council for adoption.

Planning Team

The Planning Team will be responsible for coordinating implementation of plan action items and undertaking the formal review process. The convener will assign representatives from City departments, divisions, and agencies, including, but not limited to, the current Planning Team.

In order to make the Planning Team as broad and useful as possible, the Planning Services Manager may choose to involve other relevant organizations and agencies in hazard mitigation. These additional appointments could include:

- ✓ A representative from the American Red Cross
- ✓ A representative from a county government emergency response agency

The Planning Team will meet no less than annually. Meeting dates will be scheduled once the final Planning Team has been established. These meetings will provide an opportunity to discuss the progress of the action items and maintain the partnerships that are essential for the sustainability of the mitigation plan.

*Implementation through Existing Programs**

The City of Whittier addresses statewide planning goals and legislative requirements through its General Plan, its Capital Improvement Plan, and Building and Safety Codes. The Mitigation Plan provides a series of recommendations - many of which are closely related to the goals and objectives of existing planning programs. The City of Whittier will implement recommended mitigation action items through existing programs and procedures. The City of Whittier fully intends to integrate the Mitigation Actions identified in this Mitigation plan into its General Plan at the earliest opportunity. The greatest impediment to this accomplishment has been a lack of adequate funding.

The City's Community Development Department- Building and Safety Division is responsible for adhering to the State of California's Building and Safety Codes. In addition, the Planning Team will work with other agencies at the state level to review, develop and ensure Building and

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* **ELEMENT C. MITIGATION STRATEGY | C6**

C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))

Safety Codes are adequate to mitigate or present damage by hazards. This is to ensure that life-safety criteria are met for new construction.

Some of the goals and action items in the Mitigation Plan will be achieved through activities recommended in the CIP. Various City departments develop the CIP and review it on an annual basis. Upon annual review of the CIP, the Planning Team will work with the City departments to identify areas that the Mitigation Plan action items are consistent with CIP goals and integrate them where appropriate.

Within six months of formal adoption of the Mitigation Plan, the recommendations listed above will be incorporated into the process of existing planning mechanisms at the City level. The meetings of the Planning Team will provide an opportunity for Planning Team members to report back on the progress made on the integration of mitigation planning elements into City planning documents and procedures.

Economic Analysis of Mitigation Projects

FEMA's approach to identify the costs and benefits associated with hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis.

Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster-related damages later.

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. Determining the economic feasibility of mitigating hazards can provide decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Given federal funding, the Planning Team will use a FEMA-approved benefit/cost analysis approach to identify and prioritize mitigation action items. For other projects and funding sources, the Planning Team will use other approaches to understand the costs and benefits of each action item and develop a prioritized list. For more information regarding economic analysis of mitigation action items, please see Appendix B: Benefit/Cost Analysis.

Evaluating and Updating the Plan*

Formal Review Process

The Mitigation Plan will be evaluated by the Mitigation Planning Team on an annual basis to determine the effectiveness of programs, and to reflect changes in land development or programs that may affect mitigation priorities. The Convener (Planning Team Chair) or designee will be responsible for contacting the Planning Team members and organizing the annual meeting. Each Planning Team member represents a City Department and as such they are responsible for monitoring and evaluating their Department's status on the mitigation

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* **ELEMENT A: PLANNING PROCESS | A6**

A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))

strategies in the Plan. The date of the annual review will be based on the FEMA approval date. The Planning Team will utilize track changes on the Word version of the FEMA approved Plan to capture all updates.

At each of the annual Planning Team meetings, the Convener will facilitate a discussion on each section of the FEMA approved Plan.

Executive Summary – During the annual review, this should be the last section updated, as it summarizes the entire document.
Introduction – Update as necessary, including regulatory changes.
Community Profile – Utilize the best available demographic resources (State Department of Finance, City's Housing Element).
Risk Assessment & Hazard-Analysis - Determine if this information should be updated or modified, given any new available data.
Mitigation Strategies - Review the goals and action items to determine their relevance to changing situations in the City, as well as changes in State or Federal policy, and to ensure they are addressing current and expected conditions. Most importantly, is the thorough review of the Mitigations Actions Matrix. The coordinating organizations responsible for the various action items will report on the status of their projects, the success of various implementation processes, difficulties encountered, success of coordination efforts, and which strategies should be revised.

Table: Mitigation Actions Matrix

Action Item Code	Action Item	Coordinating Organization	Timeline	Plan Goals Addressed					Rank - Low, Med, High	Funding Source (u/k = unknown, CB = City Budget, GF = Grant Funded)	2016 Comments (Status - Completed, Revised, Deleted, New, and Deferred)	Planning/Policy Mechanism (HMP=Hazard Mitigation Plan, GP=General Plan, CIP=Capital Improvement Plan, CB=City Budget, GF=Grant Funded), UWMP=(Urban water Management Plan)
				Protect Life and Property	Public Awareness	Natural Systems	Partnerships and Implementation	Emergency Services				
Multi-Hazard Mitigation Action Items												
MH 1	Reference the Natural Hazard Mitigation Plan in the next General Plan Safety Element update.	Community Development Department (CD)	5 years	X	X	X	X	X	High	u/k	Deferred – no General Plan update since the 2010 Mitigation Plan.	HMP
MH 2	Identify and pursue funding opportunities to develop and implement local mitigation activities.	Emergency Services Coordinator (ESC)	Ongoing	X	X	X	X	X	High	CB		CB

The Convener will assign the duty of updating the Plan to one or more of the Planning Team members. The designated Planning Team members will have three months to make appropriate changes to the Plan before submitting it to the Planning Team members. The Planning Team will also notify all holders of the City plan when changes have been made. Every five years the updated plan will be submitted to the State Hazard Mitigation Officer at the California Office of Emergency Services and the Federal Emergency Management Agency for review and approval.

*Continued Public Involvement**

The City of Whittier is dedicated to involving the public directly in the continual review and updates to the Mitigation Plan. Copies of the plan will be catalogued and made available at City Hall and at all City operated public libraries. The existence and location of these copies will be publicized in City newsletters and on the City website. This site will also contain an email address and phone number where people can direct their comments and concerns. A public meeting will also be held after each evaluation or when deemed necessary by the Planning Team. The meetings will provide the public a forum in which they can express their concerns, opinions, or ideas about the Plan.

The Public Information Officer will be responsible for using City resources to publicize the annual public meetings and maintain public involvement through the public access channel, web page, and newspapers.

* **ELEMENT A: PLANNING PROCESS | A5**

A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))

Part IV: APPENDIX

Benefit/Cost Analysis

Benefit/cost analysis is a key mechanism used by the California Office of Emergency Services, the Federal Emergency Management Agency, and other state and federal agencies in evaluating hazard mitigation projects, and is required by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended.

This appendix outlines several approaches for conducting economic analysis of hazard mitigation projects. It describes the importance of implementing mitigation activities, different approaches to economic analysis of mitigation strategies, and methods to calculate costs and benefits associated with mitigation strategies. Information in this section is derived in part from: The Interagency Hazards Mitigation Team, State Mitigation Plan, and Federal Emergency Management Agency Publication 331, Report on Costs and Benefits of Hazard Mitigation.

This section is not intended to provide a comprehensive description of benefit/cost analysis, nor is it intended to provide the details of economic analysis methods that can be used to evaluate local projects. It is intended to: 1) raise benefit/cost analysis as an important issue, and 2) provide some background on how economic analysis can be used to evaluate mitigation projects.

Why Evaluate Mitigation Strategies?

Mitigation activities reduce the cost of disasters by minimizing property damage, injuries, and the potential for loss of life, and by reducing emergency response costs, which would otherwise be incurred.

Evaluating hazard mitigation provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects.

Evaluating hazard mitigation provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. Evaluating mitigation projects is a complex and difficult undertaking, which is influenced by many variables.

First, natural disasters affect all segments of the communities they strike, including individuals, businesses, and public services such as fire, police, utilities, and schools. Second, while some of the direct and indirect costs of disaster damages are measurable, some of the costs are non-financial and difficult to quantify in dollars. Third, many of the impacts of such events produce "ripple-effects" throughout the community, greatly increasing the disaster's social and economic consequences.

While not easily accomplished, there is value, from a public policy perspective, in assessing the positive and negative impacts from mitigation activities, and obtaining an instructive benefit/cost comparison.

Otherwise, the decision to pursue or not pursue various mitigation options would not be based on an objective understanding of the net benefit or loss associated with these actions.

What are Some Economic Analysis Approaches for Mitigation Strategies?

The approaches used to identify the costs and benefits associated with hazard mitigation strategies, measures, or projects fall into two general categories: benefit/cost analysis and cost-effectiveness analysis. The distinction between the two methods is the way in which the relative costs and benefits are measured. Additionally, there are varying approaches to assessing the value of mitigation for public sector and private sector activities.

Benefit/Cost Analysis

Benefit/cost analysis is used in hazards mitigation to show if the benefits to life and property protected through mitigation efforts exceed the cost of the mitigation activity. Conducting benefit/cost analysis for a mitigation activity can assist communities in determining whether a project is worth undertaking now, in order to avoid disaster related damages later. Benefit/cost analysis is based on calculating the frequency and severity of a hazard, avoided future damages, and risk.

In benefit/cost analysis, all costs and benefits are evaluated in terms of dollars, and a net benefit/cost ratio is computed to determine whether a project should be implemented (i.e., if net benefits exceed net costs, the project is worth pursuing). A project must have a benefit/cost ratio greater than 1 in order to be funded.

Cost-Effectiveness Analysis

Cost-effectiveness analysis evaluates how best to spend a given amount of money to achieve a specific goal. This type of analysis, however, does not necessarily measure costs and benefits in terms of dollars. Determining the economic feasibility of mitigating hazards can also be organized according to the perspective of those with an economic interest in the outcome. Hence, economic analysis approaches are covered for both public and private sectors as follows.

Investing in public sector mitigation activities

Evaluating mitigation strategies in the public sector is complicated because it involves estimating all of the economic benefits and costs regardless of who realizes them, and potentially to a large number of people and economic entities. Some benefits cannot be evaluated monetarily, but still affect the public in profound ways.

Economists have developed methods to evaluate the economic feasibility of public decisions that involve a diverse set of beneficiaries and non-market benefits.

Investing in private sector mitigation activities

Private sector mitigation projects may occur on the basis of one of two approaches: it may be mandated by a regulation or standard, or it may be economically justified on its own merits. A building or landowner, whether a private entity or a public agency, required to conform to a mandated standard may consider the following options:

1. Request cost sharing from public agencies
2. Dispose of the building or land either by sale or demolition
3. Change the designated use of the building or land and change the hazard mitigation compliance requirement; or
4. Evaluate the most feasible alternatives and initiate the most cost effective hazard mitigation alternative

The sale of a building or land triggers another set of concerns. For example, real estate disclosure laws can be developed which require sellers of real property to disclose known defects and deficiencies in the property, including earthquake weaknesses and hazards to prospective purchasers. Correcting deficiencies is expensive and time consuming, but their existence can prevent the sale of the building. Conditions of a sale regarding the deficiencies and the price of the building can be negotiated between a buyer and seller.

How Can an Economic Analysis be Conducted?

Benefit/cost analysis and cost-effectiveness analysis are important tools in evaluating whether or not to implement a mitigation activity. A framework for evaluating alternative mitigation activities is outlined below:

1. Identify the Alternatives: Alternatives for reducing risk from hazards includes structural projects to enhance disaster resistance, education and outreach, and acquisition or demolition of exposed properties, among others. Different mitigation project assists in minimizing risk to hazards, but do so at varying economic costs.

2. Calculate the Costs and Benefits: Choosing economic criteria is essential to systematically calculating costs and benefits of mitigation projects and selecting the most appropriate alternative. Potential economic criteria to evaluate alternatives include:

- ✓ **Determine the project cost.** This may include initial project development costs, and repair and operating costs of maintaining projects over time.
- ✓ **Estimate the benefits.** Projecting the benefits or cash flow resulting from a project can be difficult. Expected future returns from the mitigation effort depend on the correct specification of the risk and the effectiveness of the project, which may not be well known. Expected future costs depend on the physical durability and potential economic obsolescence of the investment. This is difficult to project. These considerations will also provide guidance in selecting an appropriate salvage value. Future tax structures and rates must be projected. Financing alternatives must be researched, and they may include retained earnings, bond and stock issues, and commercial loans.
- ✓ **Consider costs and benefits to society and the environment.** These are not easily measured, but are assessed through a variety of economic tools including existence value or contingent value theories. These theories provide quantitative data on the value people attribute to physical or social environments. Even without hard data, however, impact of structural projects to the physical environment or to society should be considered when implementing mitigation projects.

- ✓ **Determine the correct discount rate.** Determination of the discount rate can just be the risk-free cost of capital, but it may include the decision maker's time preference and also a risk premium. Including inflation should also be considered.

3. Analyze and Rank the Alternatives: Once costs and benefits have been quantified, economic analysis tools can rank the alternatives. Two methods for determining the best alternative given varying costs and benefits include net present value and internal rate of return.

- ✓ **Net present value.** Net present value is the value of the expected future returns of an investment minus the value of expected future cost expressed in today's dollars. If the net present value is greater than the project costs, the project is determined feasible for implementation. Selecting the discount rate, and identifying the present and future costs and benefits of the project calculates the net present value of projects.
- ✓ **Internal Rate of Return.** Using the internal rate of return method to evaluate mitigation projects provides the interest rate equivalent to the dollar returns expected from the project. Once the rate has been calculated, it is compared to rates earned by investing in alternative projects. Projects may be feasible to implement when the internal rate of return is greater than the total costs of the project.

Once the mitigation projects are ranked on the basis of economic criteria, decision-makers can consider other factors, such as risk; project effectiveness; and economic, environmental, and social returns in choosing the appropriate project for implementation.

How are Benefits of Mitigation Calculated?

Economic Returns of Hazard Mitigation

The estimation of economic returns, which accrue to building or land owner as a result of hazard mitigation, is difficult. Owners evaluating the economic feasibility of mitigation should consider reductions in physical damages and financial losses. A partial list follows:

- ✓ Building damages avoided
- ✓ Content damages avoided
- ✓ Inventory damages avoided
- ✓ Rental income losses avoided
- ✓ Relocation and disruption expenses avoided
- ✓ Proprietor's income losses avoided

These parameters are estimated using observed prices, costs, and engineering data. The difficult part is to correctly determine the effectiveness of the hazard mitigation project and the resulting reduction in damages and losses. Equally as difficult is assessing the probability that an event will occur. The damages and losses should only include those that will be borne by the owner. The salvage value of the investment are important in determining economic feasibility. Salvage value becomes more important as the time horizon of the owner declines. This is important because most businesses depreciate assets over a period of time.

Additional Costs from Hazards

Property owners should also assess changes in a broader set of factors that change as a result of a large natural disaster. These are usually termed "indirect" effects, but they have a very direct effect on the economic value of the owner's building or land. They are positive or negative, and include changes in the following:

- ✓ Commodity and resource prices
- ✓ Availability of resource supplies
- ✓ Commodity and resource demand changes
- ✓ Building and land values
- ✓ Capital availability and interest rates
- ✓ Availability of labor
- ✓ Economic structure
- ✓ Infrastructure
- ✓ Regional exports and imports
- ✓ Local, state, and national regulations and policies
- ✓ Insurance availability and rates

Changes in the resources and industries listed above are more difficult to estimate and require models that are structured to estimate total economic impacts. Total economic impacts are the sum of direct and indirect economic impacts. Total economic impact models are usually not combined with economic feasibility models. Many models exist to estimate total economic impacts of changes in an economy. Decision makers should understand the total economic impacts of natural disasters in order to calculate the benefits of a mitigation activity. This suggests that understanding the local economy is an important first step in being able to understand the potential impacts of a disaster, and the benefits of mitigation activities.

Additional Considerations

Conducting an economic analysis for potential mitigation activities can assist decision-makers in choosing the most appropriate strategy for their community to reduce risk and prevent loss from hazards. Economic analysis saves time and resources from being spent on inappropriate or unfeasible projects. Several resources and models are listed on the following page that assist in conducting an economic analysis for hazard mitigation activities.

Benefit/cost analysis is complicated, and the numbers may divert attention from other important issues. It is important to consider the qualitative factors of a project associated with mitigation that cannot be evaluated economically. There are alternative approaches to implementing mitigation projects. Many communities are looking towards developing multi-objective projects. With this in mind, opportunity rises to develop strategies that integrate hazard mitigation with projects related to watersheds, environmental planning, community economic development, and small business development, among others. Incorporating hazard mitigation with other community projects can increase the viability of project implementation.

Resources

CUREe Kajima Project, Methodologies For Evaluating The Socio-Economic Consequences Of Large Earthquakes, Task 7.2 Economic Impact Analysis, Prepared by University of California, Berkeley Team, Robert A. Olson, VSP Associates, Team Leader; John M. Eidinger, GandE Engineering Systems; Kenneth A. Goettel, Goettel and Associates Inc.; and Gerald L. Horner, Hazard Mitigation Economics Inc., 1997.

Federal Emergency Management Agency, Benefit/Cost Analysis of Hazard Mitigation Projects, Riverine Flood, Version 1.05, Hazard Mitigation Economics Inc., 1996.

Federal Emergency Management Agency Report on Costs and Benefits of Natural Hazard Mitigation. Publication 331, 1996.

Goettel and Horner Inc., Earthquake Risk Analysis Volume III: The Economic Feasibility of Seismic Rehabilitation of Buildings in The City of Portland, Submitted to the Bureau of Buildings, City of Portland, August 30, 1995.

Goettel and Horner Inc., Benefit/Cost Analysis of Hazard Mitigation Projects Volume V, Earthquakes, Prepared for FEMA's Hazard Mitigation Branch, October 25, 1995.

Horner, Gerald, Benefit/Cost Methodologies for Use in Evaluating the Cost Effectiveness of Proposed Hazard Mitigation Measures, Robert Olson Associates, Prepared for Oregon State Police, Office of Emergency Management, July 1999.

Interagency Hazards Mitigation Team, State Mitigation Plan, (Oregon State Police – Office of Emergency Management, 2000).

Risk Management Solutions, Inc., Development of a Standardized Earthquake Loss Estimation Methodology, National Institute of Building Sciences, Volume I and II, 1994.

VSP Associates, Inc., A Benefit/Cost Model for the Seismic Rehabilitation of Buildings, Volumes 1 and 2, Federal Emergency Management Agency, FEMA, Publication Numbers 227 and 228, 1991.

VSP Associates, Inc., Benefit/Cost Analysis of Hazard Mitigation Projects: Section 404 Hazard Mitigation Program and Section 406 Public Assistance Program, Volume 3: Seismic Hazard Mitigation Projects, 1993.

VSP Associates, Inc., Seismic Rehabilitation of Federal Buildings: A Benefit/Cost Model, Volume 1, Federal Emergency Management Agency, FEMA, Publication Number 255, 1994.